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Pittsburgh

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THE UNITED GAS IMPROVEMENT COMPANY,

PHILADELPHIA.

—•—

BUILDERS OF

THE STANDARD DOUBLE SUPERHEATER

LOWE WATER GAS APPARATUS.

—•—

ACCURATE MEASUREMENT

OF

AIR AND STEAM SUPPLY

(PATENTED),

AFFORDING { **PERFECT CONTROL OF GENERATOR FIRE CONDITIONS.**

PRODUCING { **UNIFORM RESULTS. HIGHEST EFFICIENCIES.**

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CHEMISTRY OF THE INCANDESCENT GAS MANTLE.[1]

By Dr. H. S. Miner.

Since the wonderful and spectacular invention of Dr. Karl Auer von Welsbach, who about thirty years ago produced the incandescent gas mantle which in justice bears his name, the growth of the industry has been marked by steady improvements rather than revolutionary changes, unless we include that radical change in the composition of the mantle body which Dr. Auer himself made in the early nineties, when he substituted the thorium-cerium mixture for the more complex lanthanum-zirconium-cerium mantle. This was a radical improvement, and it marked the beginning of the general adoption of the incandescent gas mantle.

I have said that the days of *radical* developments seem to be past, and yet I never cease to wonder at the phenomenon of the change or petrifaction of the vegetable or organic fibre, reproducing the cellulose fibre in mineral form under the influence of the Bunsen flame and giving the light-producing body with which we are familiar. Although we hear the fragility of the mantle frequently alluded to, when I watch its formation in this manner, which seems to be essential to its light-giving efficiency, its strength and resiliency is a " nine days' wonder " to me.

This change in the composition of the Welsbach mantle when the mixture of 99 parts of thoria and 1 part of ceria was substituted for the earlier mixture, is to my mind an invention of the highest type, involving as it did the purification of rare earth materials beyond the limits of previous knowledge, and the development of commercial processes for their production in the highest state of purity.

Notwithstanding the claims made by many *pseudo* inventors, the thorium-cerium mixture still holds as the essential composition of all Welsbach mantles, and is the basis of the light-giving qualities of the incandescent gas mantle. Although the last quarter of a century has brought much enlightenment in the field of rare earth chemistry, no satisfactory substitute has been found for this invention of Dr. Auer's. In justice to the many rare-earth chemists throughout the world, I would say that their work has resulted in some changes and improvements in the mantle and burner which have decreased its cost and increased its efficiency and durability. Some of these points I will touch upon.

In the early days a purified cotton fabric was saturated with the thorium-cerium mixture made of materials of as high a state of purity as possible. Purity of the cellulose was found to be absolutely essential, and bleeching and washing processes were carried beyond the point previously thought necessary, and a cotton carrying less mineral substance than the best absorbent cotton was produced. Realizing the deleterious influence of foreign substances, such as silica, lime, magnesia, alumina, phosphuric acid, etc., it was recognized that it was just as harmful to have these elements brought to the mantle by the vegetable fibre as from a rare-earth mixture. It was recognized that the length of fiber or staple of the mantle fabric had much to do with its physical strength and durability. Long staple cottons were used exclusively in the best grade of goods, and the longer fibered ramie or China grass was looked upon with favor, but was not used with any success until it had been successfully de-gummed, bleached and washed. The accomplishment of this complex and difficult problem resulted in the adoption of ramie as a mantle fiber, first in Germany and then in other countries. The adoption of ramie fiber made possible the mantle of the inverted or pendant type, which has since been so generally adopted. Although the fiber length was increased from $1\frac{1}{2}$ or $1\frac{3}{4}$ inches to 5 or 6 inches by the substitution of ramie for cotton, and with certain advantages, especially in inverted mantles, yet the ideal had not been reached, and it remained for the artificial silk or artificial cellulose fibers to supply that ideal. The slow development of the artificial silk industry caused a delay in the adoption of artificial fibers for mantle making, but its strength, elasticity and maintained candle power have caused a persistance of effort that now has its reward in the arti-fiber mantel.

In the early days the only digressions from the ideal composition of 99% ThO_2 and 1% CeO, were slight variations in these figures to produce lights with varrying degrees of whiteness; an increase or decrease of ceria increasing or decreasing the yellow color of the light. The coming of ramie fiber and the inverted type of mantle made the introduction of small percentages of hardening materials essential, and beryllium oxide was found to be an ideal substance for this purpose.

The change of fiber and of the type of mantles, as indicated, has caused a complete revolution in the processes of manufacture, and notwithstanding the experience already gained, each one of these changes called forth persistent research work over a period of years before the problem could be considered solved. This is especially true of the arti-fiber mantles, and the changes in manufacturing processes have extended to the collodion or lacquer used to strengthen the mantle for transportation, as that used on the cotton or ramie mantles was found unsuited for arti-fiber mantles. The problem of primary importance for the chemical engineer has ever been the manufacture of thorium nitrate, and many changes in the commercial production of this substance have been effected during the score of years just passed. Monazite sand is still the only commercial ore from which thoria can be obtained, containing from 5% to 6% ThO_2; although small deposits of thorite and thorianite with a thoria content of 50% and 75% respectively have served to keep alive a longing for a more ideal source of supply. The high price of monazite—this very low-grade ore from a thoria standpoint, with nearly 95% waste—has thrown upon the thoria content, while still locked up in this phosphate rock, a heavy burden of expense and has made necessary the production of high yields and low costs of operation to keep the costs of thorium salts low enough to make them commercially available.

The first processes used in factory practice were naturally but enlargements of laboratory methods of analysis, but from this beginning have developed modification upon modification, substituting cheaper and cheaper reagents and methods of manipulation until the commercial processes of today hardly bear even a " famiy resemblance " to the first process employed. Modifications are, of course, continuing, and are made imperative by fluctuations in price of the ore, of some reagent, or of labor. But although there be variations in processes, there must be one unvarying standard ever before the chemist, the absolute purity of the product. Pure thoria is essential, and I am gratified to be able to say for the thoria manufacturers of the world that their product is of very high grade and is better now, notwithstanding the cheapening and shortening of processes, than it was in the beginning, although even then it

1. From paper read before N. Y. Section, Electro-Chemical Society.

was truthfully labeled "C. P." There are various chemical and physical means of checking and determining the purity of the product, but in the light of experience the most satisfactory method for both accuracy and rapidity is the manufacture of mantles from the thoria as it progresses in purity. The color of the mantle body, the color of the light produced, the presence or absence of shrinkage, the brittleness or flexibility of the mantle give to the experienced manufacturer a more satisfactory indication of the purity of the product than do chemical analyses, which are of necessity long and tedious.

The other essential material which must always accompany thoria is ceria, and although it is used in only about one-hundredth the quantity its chemistry is just as important and its purity just as essential. I am glad to say that this product is even purer than when Dr. Auer first used it in his lathanum-zirconium-cerium mantle. The oxide of cerium then obtained was of a reddish-brown tint, while that now manufactured is of a light yellow color, the former being slightly contaminated with neodymium, the last traces of which were difficult to remove. By way of variety the mantle chemist has also to manufacture beryllium, zirconium, and neodymium, each of which he uses in a limited way, and none of them are really easy to produce.

Radio-chemistry has recently thrown the thoria manufacturer into the "lime-light" because of a radio-active product three hundred times stronger than radium, which occurs in and is produced from thorium. I refer to meso-thorium, which a suffering and stricken humanity has implored the thoria manufacturers to save for them, and which the manufacturers are now unitedly conserving as a substitute for radium.

With the possible exception of the meso-thorium, every problem we have mentioned has a bearing upon the characteristics and qualities of some or all types of incandescent gas mantles. Another and no less important problem that should be alluded to is the protective coating that must be applied to a finished mantle to strengthen it for transportation. In the early part of 1888 we were dipping finished mantles in an alcoholic solution of shellac, made slightly flexible when dry by the addition of a little castor oil. Some essayed to strengthen the mantle with paraffine, and I have in my collection of curios a mantle imbedded in a cake of paraffine, which was to be removed by melting the wax. The making of solutions of nitro-cellulose or soluble cotton opened up a new field of research, and the knowledge gained of the many various forms of nitro-cellulose and the numerous solvents therefor, together with the knowledge and control of such characteristics as viscosity, hydroscopic effects, etc., have made it possible to prepare collodion solutions of almost ideal qualities for mantle purposes. And what are these ideals? A collodion must be of the proper viscosity for mantles to be dipped and withdrawn from it without rupture or strain; it must dry quickly with a film stiff enough for the mantle to be handled with safety, and strong and elastic enough to resist handling and shock; it must burn off slowly enough to prevent the mantle becoming annealed or softened, and yet must not leave the mantle body sticking to the cap of the burner. A collodion which answers all these characteristics is realized in a nitro-cellulose solution in a mixture of solvents with camphor, made flexible by castor oil.

The mantle manufacturer has held before himself for a quarter of a century and more, certain ideals towards which he has earnestly striven. Some of these have been strength with elasticity, high and maintained candle-power, preservation of color, and absence of shrinkage. A realization of these seems finally to have been met in the mantle made from the bundle of elastic, spring-like fibers known as artificial silk. for the strength of these mantles certainly is phenomenal, the high initial candle-power is not only maintained but frequently *increases*. This is made possible by the practical absence of shrinkage upon prolonged burning, and by the very curious phenomena that the mantle does not seem to collect the fine mineral dust from the atmosphere as do those manufactured from the shorter vegetable fibers, cotton and ramie, this silicious dust having a great affinity for the basic materials of the mantle body.

The attainment of this ideal has been reached only after years of persistant research, guided by many more years of experience in mantle manufacture. Old theories had to be abandoned and former methods completely changed before this mantle was commercially possible. It was a chemical problem of great complexity, and its successful solution arouses such enthusiasm that I am tempted to include this among the radical and spectacular developments in our industry.

I have described some of the chemical problems connected with the manufacture of the incandescent gas mantle. There are many more that have to deal with the process of manufacture of the mantle itself and with the economics of the industry, such as the conservation and recovery of waste product. My chief excuse of treating the subject as I have done is to make it clear that each new type of mantle developed is an independent chemical problem, beginning with the fiber of which it is formed, through every process and stage of manufacture, to the special collodion with which it is prepared for transportation. I hope I have also shown you that chemisty is just as essential for the successful operation of the incandescent mantle industry as it was in its inception and development.

[Continued from page 60.]

Welding of High Pressure Mains.

[From the paper by J. D. SHATTUCK, written for A. G. I. Meeting.]

SPECIFICATIONS FOR HIGH PRESSURE INSTALLATION.

Station.—The compressor station to consist of two steam driven, direct connected compressors, duplicate boilers, recording pressure gauge and steam gauge.

Compressors.—The capacity of the compressors to be such that either alone could supply the peak demand of the year. To be vertical, single, duplex or compound as convenience or requirements may demand.

Boilers.—The boilers to be of sufficient horse power that steam could be maintained at all times by either of the boilers singly.

Steam Connections.—A welded steam main, with connection to each boiler so run that the compressor may be connected to it as manifold. All outlets from this line to be welded and connected to compressors with a long bend of at least 3 feet radius; no fittings to be used. Extra heavy flanged unions with 1/32-inch sheet lead gaskets to be used in making connection. Unions to be welded to the pipe, or the Van Stone type of joint used.

Auxiliary Steam Line.—An auxliliary steam main connected to each boiler to be run to the compressors; to be held in reserve for such times as it is necessary to shut off main steam line.

Connection to Storage Holder.—The suction to the compressors to be by a separate outlet from storage holder. This connection to be in the shape of "U" and made of extra heavy wrought iron pipe. If building new holder, provide an extra outlet.

Inlet Connections to Compressor.—Suction connection never to be less, and preferably one size larger than the inlets or compressor.

Discharge Connections.—The discharge connections never to be less, and preferably one size larger, than the outlet openings on the compressors. Connections to be full wrought iron or steel pipe; all joints welded, except those to valves and compressor, which are to be made with evtra heavy flanged unions 1/32 inch sheet lead gasket.

Inlet and Outlet Valves —The inlet and outlet connections to be provided with gate valves and to be so arranged that either compressor may be operated independently.

Manifold and Manifold Valve.—Compressors to be connected to a manifold which connects to pulsation tank. In the manifold, beyond the by-pass and safety valves hereafter specified, a combination globe stop and check valve to be inserted.

By-pass and Safety Valve.—The by-pass with ball and lever safety valve to be connected from compressor manifold, in advance of the globe stop and check valve, to the inlet gas main of compressors, so that excess pressure may be relieved by passing gas back to the suction main.

Gas Governor.—A gas governor to be connected to the high pressure side of the compressor and throttle valves to control the pressure on the line.

Pulsation Tank.—Immediately following the compressor manifold on the outside of the building, a combination pulsation tank, condenser and expansion tank to be placed vertically above ground. The lower portion of this tank to be provided with try cocks at different heights to show the depth of condensate in the tank, some of which should be left in the tank in order that it may act as an auto enricher.

Provision to be made for blow-off pipe from bottom of tank in order that excess condensate may be removed. The inlet connection to the tank, if it cannot be straight, to be made with a bend of large radius. The outlet to be taken from the upper part of tank, and like the inlet connection, preferably straight, or made with a bend of as large a radius as possible. To be connected to the gas main by extra heavy flanged union with 1/32 inch sheet lead gaskets.

Pressure Gauges.—A high pressure recording gauge and steam

pressure gauge to be connected to high pressure gas main, mounted side by side on a board at a convenient place for observation. The steam gauge to be fitted with electric contacts set at low and high points to give warning to man in charge.

Valves.—All valves used in connections to be extra heavy cast iron.

LAYING MAINS.

Pipe Specifications.—The pipe shall be lap-welded, of Bessemer or open hearth steel of the best welding quality, free from blisters, cracks or other injurious defects; or guaranteed full weight W. I.

Inspection.—Each length to be inspected for defects inside and out. A flattening test to be made on each crop end with the weld near the side, crushing the end down to one-quarter the diameter of the pipe. It must not show cracks in the material or opening at the weld. Internal hydrostatic test is to be made on each length of finished pipe, using the pressure customary in mill practice.

Coating Pipe.—First, see that pipe is thoroughly clean and free from rust, and remove burrs or projections. Put coating material in a trough that has steam coil in the bottom. Run steam through the pipe to be coated until it is thoroughly heated and dry, then plug ends and dip into the coating. Allow it to remain long enough to completely coat it, take out and wrap with muslin or manila paper torn or cut into 5 inch strips. After being wrapped the pipe is again dipped; the excess coating removed by revolving the pipe in contact with a wooden paddle.

If it is necessary to coat pipe in the field it can be done as follows: Scour pipe with a wire brush to remove rust and scale, and see that all burrs are removed. Put the coating material in a heated pail, and apply with a 4 inch flat brush, either in advance of the pipe laying or as the pipe is laid, but always in advance of the pipe being put in the ditch. The pipe is thoroughly inspected before back filling, and abrasions recoated.

Stringing Pipe.—The pipe to be strung along the road out of gutters, and on opposite side of road from trench.

Cleaning Out Pipe.—The pipe to be thoroughly cleaned inside by pushing through a cleaner from end to end.

Pipe Inspection.—The pipe before being welded to be examined for defective lengths and to see that the pipe has been cleaned on the inside.

Joints.—Joints to be oxy-acetylene butt welded, except those otherwise specified.

Welding Pipe.—The pipe to be brought to a perfect alignment by an assistant to the welder. The welder to weld the pipe completely through the wall of the pipe and build the weld up slightly above the outside of the pipe. The finished joint to be from 90 to 100% of the tensile strength of the pipe itself.

Trench.—The trench to be of sufficient depth to insure a cover for the pipe of 2 feet 6 inches, and to be dug to proper depth and graded before lowering the pipe, the bottom of the ditch to be graded so that the pipe will lay on the bottom and drain to the low points.

Lagging Pipe.—At places where exposed, such as bridge crossings, the pipe to be lagged with asbestos pipe covering protected with a weather-proof cover.

Valves.—Steel valves to be used with extra heavy steel flanges welded to the pipe. The flange joints to be made with 1/32 inch lead gaskets. Valves to have a small equalizing by-pass connection and blow-off pipe from the under side of valve, as shown in Fig. 9.

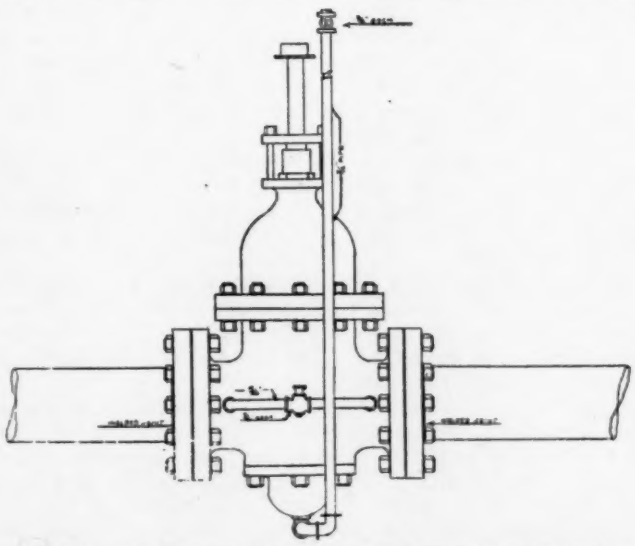


Fig. 9.—High Pressure Valve Showing By-Pass and Blow-Off Pipe.

Locating Valves.—Valves to be placed every ½ mile or as near this distance apart as possible; when a good land mark is found either a little less or a little more than the above distance it would be better to place the valve there in order to more easily find it when wanted. It may also be necessary to place valves at points where it is expected to run lateral lines from the trunk line.

Locating Drips.—At all low points in the line a drip should be placed, this to be as carefully attended to as in a low pressure line.

Style of Drip.—The drip to be made with welded joints except in connecting the riser to the body of the drip. The drip may be of the style shown in Figs. 10 or 11. If the drip must be located

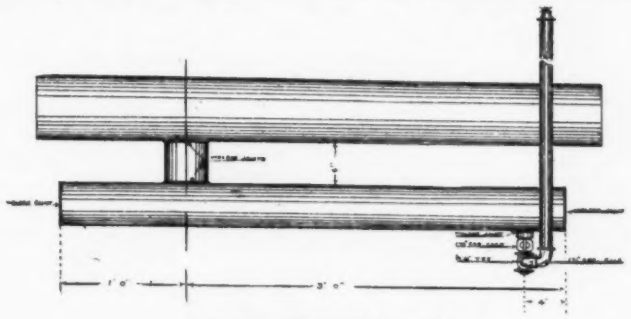


Fig. 10.—Welded Drip. Style 1.

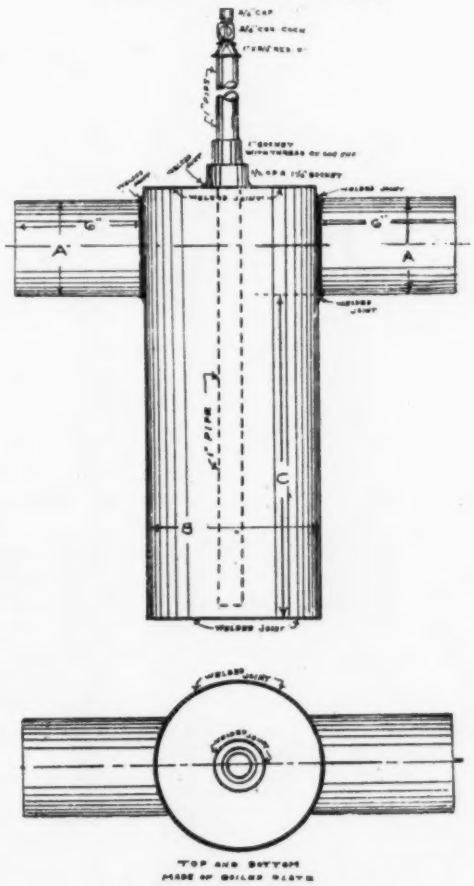


Fig. 11.—Welded Drip. Style 2.

in rock, style No. 2 may be used, but if digging is good use style No. 1.

Turns and Bends.—Where the line turns and it is contemplated extending over the first road at some future time, weld into the line at a suitable angle a full sized branch piece from which the future main can be extended, with a welded flange closed by a blank flange, thus providing for future valve connection.

At other turns use a pipe bend of at least 6 feet radius, the bends made cold on the job. Up to and including 4 inches they can be made with man power, above this size with dydraulic jacks.

Branch Connections.—No fittings to be used. At street intersections where it may be desired to extend a main in the future, a branch piece with welded flanged on the end can be welded to the main. The main not to be tapped until branch is extended.

Grade.—The pipe to be laid to grade with as great care as in laying a low pressure line. The line to be leveled where necessary with blocks of wood; stone not permitted.

Expansion.—No expansion joints to be used. Contraction of

the pipe to be provided for by the pipe not being in a perfectly straight line in the ditch. To take care of contraction near valves, the companion flanges for the valves should be bolted together without the valve until line is laid, then separated to insert valve by lifting the pipe. Insert the valve and crowd pipe back into trench.

Sharp Angle Turns.—Where there is a sharp angle, or turn in the road which requires springing the pipe to get it in the ditch, bend the pipe so that it will lay in the ditch without springing.

Testing.—The line to be tested with an air pressure considerably in excess of the pressure to be carried; if to carry from 30 to 40 pounds it should then be tested with 50 to 60 pounds, and while pressure is on go over all joints with soap suds. Leaks found, to be repaired by welding over the leaking portion and again testing as before.

Roadway Boxes.—All valves and drips to be provided with roadway boxes.

Back Filling.—The ditch to be thoroughly tamped and finished in such a manner that no accidents will result from soft ditches. If through rock, the pipe to be covered with a good covering of dirt before any rock is placed in the ditch.

Lateral Main Connections.—Connections for a lateral main to be made with a steel valve of the size of the main extended. Through this valve, tap the trunk main with a high pressure tapping machine, using a drill of diameter sufficient to give delivery required. (Fig. 12).

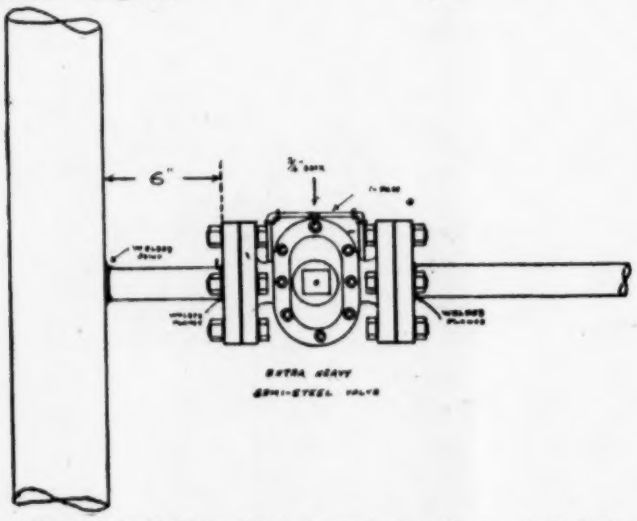


Fig. 12.—Welded Lateral Main Connection for Sizes from ¾ inch Up.

Valve and Drip Markers.—All valves and drips to be marked, if it is impossible to locate in relation to a permanent land mark, by a marker set at the side of the roadway. The marker, a 4 inch pipe, 2 feet 6 inches long, set in concrete and filled to within 1½ inch of top with concrete, filling the 1½ inch with a mixture of cement and sand, into which tacks or small nails are set in outline of the distance from marker to valve or drip. (Fig. 13.)

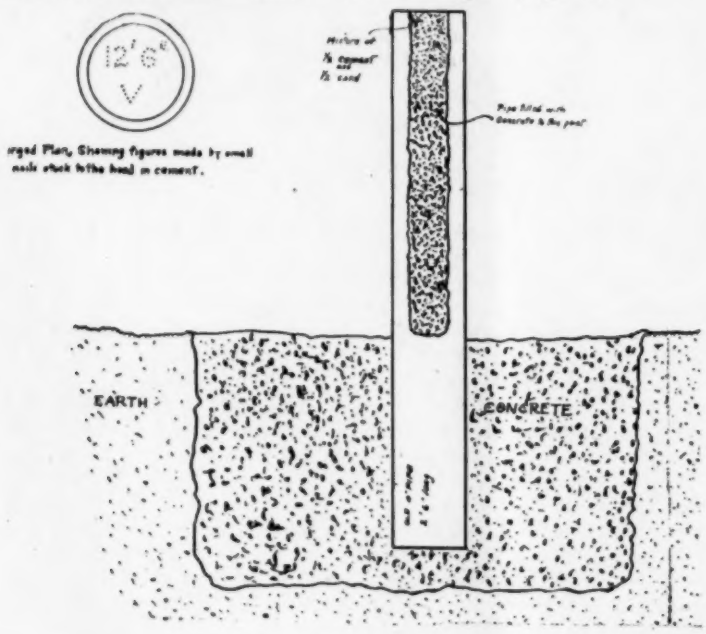


Fig. 13.—Valve and Drip Marker.

Pipe.—To be standard plain end pipe, the ends chamfered to 30°, and finished smooth with no burrs or ragged edges. Standard weights: 1½ inch to weigh 2.717 lbs.; 2 inch, 3.652 lbs.; 3 inch, 7.575 lbs.; 4 inch, 10.79 lbs.; 6 inch, 18.974 lbs., and 8 inch 28.554 lbs. per lineal foot. Pipe weighing 5% less than these weights not to be received. Pipe to be random lengths 35 feet to 40 feet.

Valves up to 4 inch.—Valves to be extra heavy flanged, bronze spindle, gas valves, specially desighed for high pressure gas and specified as follows:

Extra heavy Ferro steel, bronze spindle, clean-out pocket flange gate valve with wedged gate. The flange between body and bonnet to be made up with lead gasket. Clean-out pocket to be tapped for a ¾ inch pipe connection. Stuffing box to be twice the usual depth. Valves to open to the left with non-rising stem.

Valves above 4 inch.—To be specified as those from 4 inch down, except that they be extra heavy steel.

Roadway Boxes.—Roadway boxes for drips to be round, 8 inch in diameter; the body made in one piece with large flanged bottom. Box for valves to be round extension box with plug cover.

Pipe Coating.—The most practical coating is a coal tar pitch, free from water, acids or soluble mineral matter; as hard as it is possible to make it without decided brittleness at ordinary temperatures. It should not crack when struck a hard blow.

Laying Services.

Size.—Service to be ¾ inch.

Connection for Services.—To be made by cutting an ordinary ¾ inch socket in two, welding the plain end of one-half to the main. Tap main ⅜ inch through a ¾ inch corporation cock screwed into the socket. Screw on to cock a ¾ inch galvanized tee and into the side outlet of tee screw a ¾ inch galvanized service ell, from which extend the service.

When service is to carry pressures above 30 lbs. the connection to be made as follows: Weld to the main a ¾ inch steel body corporation cock, or preferably a ¾ inch steel body gate valve provided with plain ends for welding. Through this cock tap the main as specified above, extending the service by welding pipe to the cock, using no fittings.

Joints.—The only screw joints to be those of the swing at the main and at the curb and lock cocks: all other joints welded.

Dope for Screw Joints.—The thread dope to be one of the following mixtures: ⅓ raw linseed oil and ⅔ Portland cement, or equal parts of red and white lead mixed with linseed oil.

Fall of Pipe.—The service to be laid with a grade of at least 1 inch to 10 feet, and without any sags. The ditch to be carefully bottomed up, or the pipe leveled with blocking. No stones permitted.

Blow-off.—The service gang to extend a ¾ inch blow-off pipe from inside of cellar to the outside. The outlet of this pipe never to be under a porch, or at any place where the gas could not escape at once to the outer air. The fall of this pipe to be toward the celler.

Painting Threads.—In making screw joints thread dope to be painted on the male thread only.

Curb Cock and Box.—Use ¾ inch curb cock with standard extension curb box. The key of the cock to be solid with full way opening.

For services to carry pressures above 30 lbs., a special steel body cock, or steel body gate valve with suitable ends for welding. This valve to be protected as much as possible from moisture and dirt.

Lock Cock.—On the end of the service inside of the cellar wall, a ¾-inch lock cock to be used; the key solid with a 3/16 inch drilled hole at the bottom of the body opening.

Governor.—The governor to be combination governor and seal; size governed by the demand. The governor to be sealed with mercury to blow at a pressure of about 6 inches water column.

Fittings.—All fittings used in connecting governor to be best malleable galvanized.

Connection to Blow-Off.—From outlet on the governor connection to be made with ¾-inch pipe to the blow-off pipe. This connection to rise from the governor 10 inches or 12 inches before turning down to be connected. The blow-off pipe on the combination governor is also the vent.

Service Protector.—The service pipe through the cellar wall to be protected by reinforcing with a piece of 1¼-inch pipe, the annular space between the two pipes filled with pitch. Lengths of ¾-inch pipe to be made up with protectors and kept in stock ready for use. The protector is a precaution against the possibility of the service pipe rusting out in the cellar wall. (See Fig. 3.)

Coating.—For specification see that for mains.

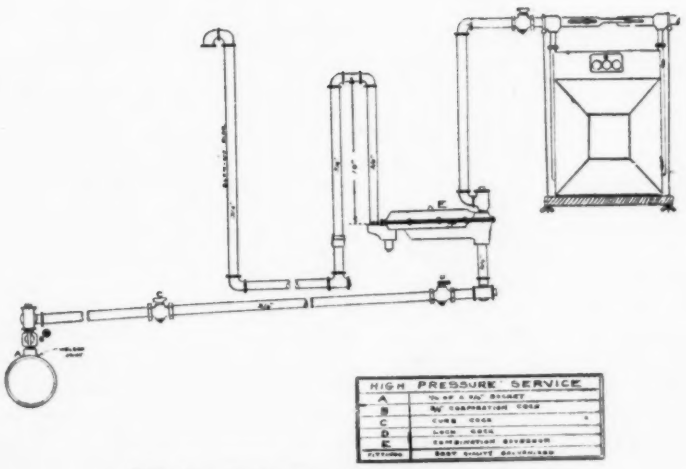


Fig. 14—Service Cover and Meter Connections.

Pipe.—The pipe to be standard ¾-inch steel pipe, to weigh 1.13 pounds per foot. The plain end pipe to be finished with straight even edge.

Curb Cock.—To be of brass, the best quality obtainable, and drilled with a full way opening.

Lock Cock.—To be best quality obtainable, drilled 3/16 inch at the bottom of the body opening.

Corporation Cock.—To be the best quality obtainable, made of brass and with ½ inch opening,

Plain End Corporation Cock.—To have heavy steel body and bronze plug. The ends to be 2 to 3 inches long.

Valves.—The gate valve to be extra heavy steel bronze mounted with plain ends. To open to the left, and on the stem a head provided that will allow an ordinary curb key to be used.

Curb Box.—The curb box to be standard extension box used for low pressure service.

District Regulators.

When a low pressure district is served from one high pressure source, a "Double District Regulator" to be installed between the high pressure and low pressure mains; capable of lowering the pressure from 30 pounds or more carried in the high pressure mains to the desired pressure in inches of water on the low pressure mains. It has two main regulators, each with valves at inlet and outlet. One side should be shut off, to be used in case the one in action gets out of order.

Where a district is served from two or more sources a single district regulator to be used at each point of supply, as there is no danger of the gas supply being shut off by one regulator getting out of order.

When a low pressure district has its gas supply boosted from a high pressure line, the single district regulator to be installed.

Pressure Gauges.—A high pressure recording gauge and a low pressure recording pressure gauge to be attached to the regulator, brought together on one board; provision to be made on the pipe to the low pressure gauge for a "U" gauge in order that the accuracy of the former may be tested.

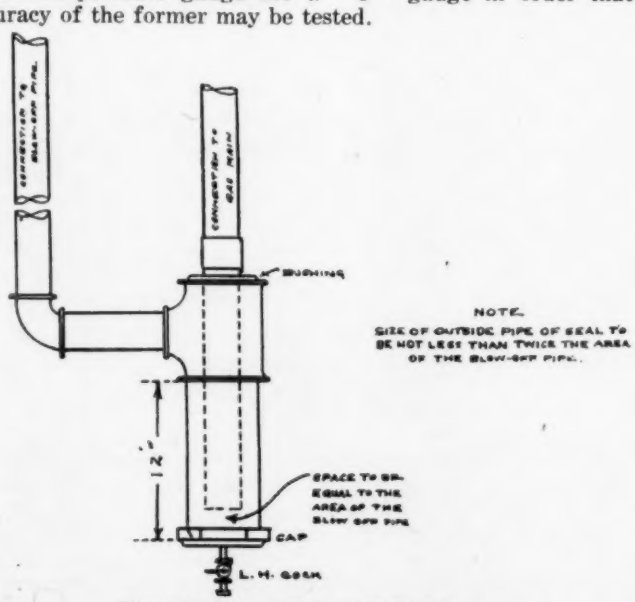

BUSHING
NOTE.
SIZE OF OUTSIDE PIPE OF SEAL TO BE NOT LESS THAN TWICE THE AREA OF THE BLOW-OFF PIPE.
12"
SPACE TO BE EQUAL TO THE AREA OF THE BLOW OFF PIPE
CAP

Fig. 15.—Mercury Seal for District Governor.

Safety Seal and Blow-Off.—A blow-off pipe from safety seal to be carried to the outside air. The blow-off pipe to be 1½ inch, 2 inches or 3 inches, determined by the size of the high pressure main and the distance necessary to reach the outside air. When the run is not over 15 feet, 1½ inch to be used for a 2-inch main and 2 inches for a 3-inch or 4-inch main; when run is larger, use 2 inches for a 2-inch main and 3 inches for a 3-inch main. The mercury seal to be sufficient to carry a pressure a little in excess of that in the low pressure system. Mercury should be free from lead, specific gravity 13.58 to 13.59. (Fig. 15.)

Housing.—The regulator to be preferably in a pit in the roadway constructed of reinforced concrete, and water-tight. A drain to be run, if possible, from pit to sewer. The hinged manhole cover to be provided with a balance weight to assist in opening. If conditions do not permit manholes, a house of a suitable size to be built for the regulator.

Locating.—The regulator to be at a point in the road or street insuring drainage of water from the manhole at all times; this to be very carefully attended to even though a sewer connection can be secured to carry the water off, as it is very important to have the regulator in a dry place.

Is the Sale of Gas-Electric Fixtures by Gas Companies Desirable?[1]

By R. F. Pierce.

It may be well at the outset to state the common arguments against the selling of combination fixtures, and consequent installation of both electric wiring and gas piping throughout buildings, limiting ourselves for the moment to the consideration of dwellings. The most obvious objections, and the one that arises first in the mind of the consumer, is the additional expense for wiring. This objection also has weight with the architect, and less directly with the gas company. A more common objection from the straight gas company's point of view is that the installation of combination fixtures obviously assists the competitive illuminant in obtaining a foothold, and interferes with the maintenance of that air-tight monopoly which most business men seem to imagine desirable although they all loudly protest that fair competition is an admirable thing—in the other fellows business. The combination company raises the additional objection that such installations foster a tendency to shift from one illuminant to the other.

From the Consumers Point of View.—The increased cost to the consumer is surely justified by the better service obtained. The reliability of gas service is one of its greatest advantages, particularly for illumination. It is an advantage upon which emphasis may be laid legitimately and it should be capitalized for all it is worth. In the next place, a combination installation enables the consumer to take advantage not only of all future improvements in the use of either illuminent, but also such miscellaneous appliances—irons, chafing dishes, toasters, heaters, etc., etc., as are now available for either illuminant, or may be developed in the future. On the other hand, a straight gas installation or a straight electric installation restricts the customer's use of modern conveniences to those available for a single illuminant.

From the Point of View of the Straight Gas Company.—The contention that the installation of gas-electric lighting fixtures assists the competitive illuminant in getting a foothold, is a confession of weakness, whereas the opposite policy of vigorously pushing combination fixtures is the best possible evidence to the consumer of the confidence with which the gas company regards the lighting field. It shows that the gas company is willing to let the sale of gas for illumination rest solely on the appreciation of the public, and to that end not only interposes no obstacle to the use of competitive illuminants, but actually advises that facilities be provided for their use.

The obvious answer of the pessimist will be that under such circumstances the competitive illuminant will be preferred to gas, and the obvious reply to the pessimist is that nothing of the sort will take place, if actual practice and experience may be regarded as better criteria than jaundiced imaginings. And even if, in some cases, the installation of combination fixtures enabled electricity to get a foothold, there is a vastly greater number of cases in which it is the *only means of obtaining a foothold for gas.* Most builders are convinced that the absence of electric wiring and fixtures greatly reduces both the renting and selling value of residence properties. Between straight gas fixtures and straight electric fix-

1. Paper read before New Jersey State Gas Association at Glassboro.

tures there will be no hesitation. The combination fixture, however, gives gas at least a fighting chance, and if this fighting chance is supported by properly designed fixtures, good maintenance and gas service, gas is in the stronger position of the two.

In Wilmington, Del., where the gas company pushes combination fixtures vigorously, the results of this policy have been most gratifying. In 1913, 95% of the new residence buildings erected there were fixtured according to the gas company's specifications, and in 85% of the buildings the fixtures were furnished by the gas company. According to census taken by the company, 52% of the new buildings fixtured with combination fixtures were using gas exclusively for illumination, 12% were using electricity exclusively, and 35% were using both—usually gas in the kitchen and living-room, the most desirable rooms from the standpoint of revenue. In only 3% of the cases was the use of gas restricted to emergency lighting. It is safe to say that 90% of this business never would have been connected if the gas company had not advocated and sold combination fixtures.

The case with which a customer may shift from one illuminant to the other is not an unmixed nuisance by any means. In the first place, it makes for the customer's satisfaction. If he has only gas available, any trifling annoyance will sharpen his appreciation of and desire for electricity. He has right at hand all the short comings of gas, but none of those of electricity; and he calls to mind only the advantages of the latter whenever gas lamp troubles direct his attention to the subject. If, however, he has an opportunity to turn instantly to electricity, his momentary resentment against gas will be greatly lessened, and his experience with electric illumination will in all likelihood bring him back to where he started.

This feature is also of interest to combination companies, for the annoyance and resentment which would otherwise follow a few hours accidental suspense of electrical supply do not exist if gas lighting is instantly available. Then, too, the case with which a portion of the lighting load may be shifted from the electric station to the gas works in case of commercial exigency, is well worth considering. The load curve of a generating station may easily assume such a form that a reduction in the lighting peak becomes imperative. In a district in which combination fixtures predominate, a little judiciously directed sales activity will accomplish this at trifling expense to the company and none to the consumer.

Assuming that the combination fixture is the inevitable solution of the new building problem—an assumption which I believe justified by the conditions—it remains to decide upon the type of fixture. Since any unlighted glassware detracts from the appearance of a lighted fixture, it is desirable to place both gas and electric lamps in the same glassware. This is only practicable in domes, in portable reading lamps and in semi-indirect fixtures. Where fixtures of the chandelier type are required it is best to place the gas lamps on upright outlets, equipping them with suitable glassware for semi-indirect lighting, and the electric lamps in an inverted position. By this arrangement the electric installation will be highly efficient as regards the production of illumination—a consideration of importance in an expensive illuminant—while the gas installation will be far superior in illuminating effect, though more wasteful—a fault that may readily be overlooked in such as inexpensive illuminant. This arrangement may, and in fact should, be used in the equipping of existing fixtures, on most of which open flame tips are provided. This fact, heretofore an obstacle in the way of gas lighting, may now be turned to good account.

Whatever attitude is taken toward the combination fixture, there is one point that should always be before us. The combination fixture will justify its sale if it does not more than ensure gas piping in every room in the house.

In many localities the number of meters per customer has about reached the saturation point. Any future increases in sales per capita in these situations must come largely through diversified application, miscellaneous appliances, etc., and the important thing in the sale of appliances is having gas where the appliance is to be used. The sale of combination fixtures should exercise a powerful effect in ending the pernicious habit of stopping the gas piping at the kitchen.

DOMESTIC FUEL APPLIANCES FROM THE CONSUMERS' POINT OF VIEW.[1]

A study of present conditions among gas companies shows that from 60 to 85% of gas consumers use gas ranges, which means that there is still a great deal of new business waiting to be developed on this particular appliance alone. Your committee, realizing this fact, has endeavored to determine conditions among gas consumers to find the reason why every one is not a fuel user.

In order to obtain information on the consumers' views of the value of gas appliances, this committee sent the following letter to 38 new business managers in all parts of the country:

"The Domestic Fuel Appliance Committee of the National Commercial Gas Association is writing this letter to ask your co-operation in a general movement to increase the use of domestic fuel appliances.

"In order to do this, it is necessary to know what the present opinion of the consumer is, and since the salesmen come more often in contact with the public than any other employee, we ask you to make a canvass of your sales force and get from them their personal experiences in the field. We want to hear about the boosts as well as the kicks.

"A collection of these experiences will make instructive and interesting reading, and since we hope to gather them from every part of the country, they ought to give a very good line on the advantages and disadvantages of gas appliances from the consumer's viewpoint.

"The advantages will make good advertising, since it is an actual user who is giving an opinion, and when the disadvantages are ascertained the committee will take steps to have them removed as far as possible.

"Thanking you in advance for your kindness in this matter, we are, Very truly yours,

COMMITTEE ON DOMESTIC FUEL APPLIANCES."

Further, the members of the committee and their friends, approached a total of 200 consumers and non-consumers, discussed the domestic fuel proposition in a general way, and obtained their opinions.

The results of these investigations follow, and illustrate how much in need of education in gas matters is the average person in some localities.

REASONS GIVEN FOR NOT USING GAS FOR COOKING.

1. High bills.
2. Lack of hot water.
3. Coal range helps to heat house in winter, provides hot water.
4. Accustomed to cooking on coal range, do not understand how to operate gas range.
5. Afraid of gas range.
6. Believe fumes from gas injurious to the food.
7. Cannot bake good bread in a gas oven.
8. Coal range good enough for Mother, good enough for me.
9. Children often turn on valves.
10. Unable to keep things warm on gas range.
11. Corn cobs quick and cheaper than gas.

Advantages and Disadvantages of the Gas Range.—It was found that the value of the gas range was fully appreciated by the majority of consumers, but in nearly every case there were some disadvantages to set against this. There were very few complaints as to the results obtained from a gas range, the general opinion being that it is the best method of cooking. The complaints of poor results were in the majority of cases due to poor combustion, and were easily removed when brought to the attention of the company.

ADVANTAGES.

1. Easy to operate.
2. Kitchen always cool.
3. Only uses fuel while cooking.
4. Cheaper than coal.
5. Very convenient when meals have to be cooked in a hurry.
6. Can give all attention to the cooking, the heat will take care of itself, no drafts to regulate.
7. No ashes and dirt to get rid of.
8. Saves time and work.
9. Better results can be obtained than from a coal range.
10. No kindling to chop.

1 From Report of Domestic Fuel Appliance Committee, N. C. G. A., by Mr. J. J. Burns, Chairman.

11. No coal and wood to carry.
12. Saving in food prepared.
13. Broiling healthful and practical with a gas range.

DISADVANTAGES.

1. Lack of hot water.
2. Does not help to heat house in winter.
3. Hard to keep stove clean.
4. High bills.
5. Burners get out of adjustment.
6. No use for baking.
7. Blackens cooking utensils.
8. Shelf underneath stove is dirt catcher and requires considerable work to keep clean.

Advantages and Disadvantages of the Water Heater.—The value of the water heater, we regret to state, is not so *generally* recognized by the average consumer, in fact, it seems that the public has not had sufficient demonstration, for your committee finds that the consumer has more objections than praise to give. About the only advantage cited by the consumer is the fact that any quantity of hot water may be had any time it is needed; in nearly every case, however, he believes he is paying a high price for this service. The objections are:

1. A luxury for the rich.
2. Hot water costs more than wine.
3. A water heater needs adjusting frequently.
4. Danger of explosion.
5. Certain types heat more water than is required.
6. Become rusty.
7. No boiler installed.
8. No hot water piping installed.

PROGRESS IN DOMESTIC FUEL APPLIANCE BUSINESS.

Since but few gas companies have accurate records of the illuminating and fuel appliances connected to their mains, and since it is impossible to determine the gas used for lighting and that used for fuel, statistics of the increase in fuel business must to a large extent be estimated.

The United States Census report of 1910 shows that the quantity of gas made in 1904 and 1909 was:

1909	150,835,793 M cu. ft.
1904	112,549,979 M cu. ft.
Increase	38,285,814 M cu. ft. or 34.0%

It may be safe to assume that of the total gas made, between 40 and 50% was sold for fuel purposes.

From the same source it is found that the increase in the quantity of electricity made between 1902 and 1907 was as follows:

1907	5,862,276,737 K. W. Hrs.
1902	2,507,051.115 K. W. Hrs.
Increase	3,355,225,622 K. W. Hrs. or 133.75%

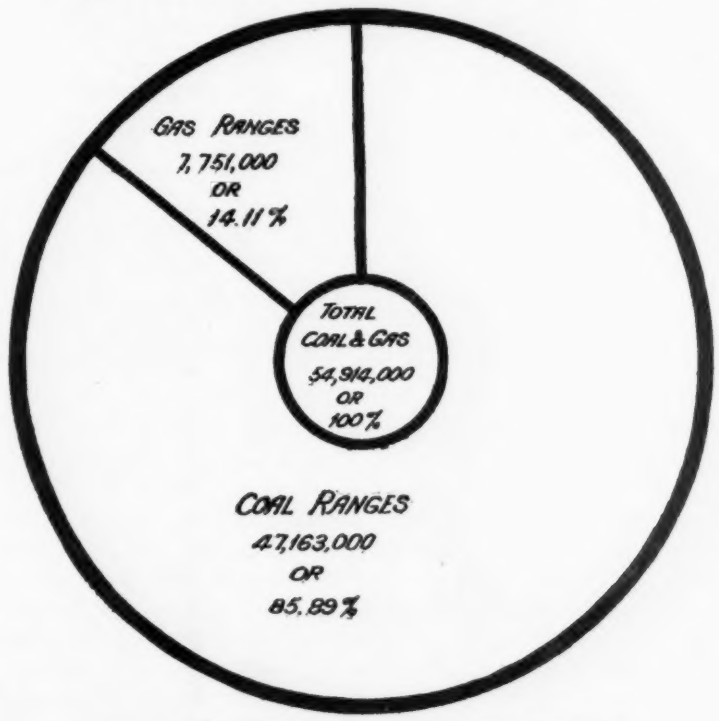
This shows the development of electricity in the lighting and power fields; and it is probable that all the increase in gas made (and possibly more where the illuminating business is not considered or protected) is due to domestic and industrial fuel business. In other words, if the fuel business had not been enlarged and the lighting end had lain dormant, the gas industry as a whole would probably have shown a decrease instead of an increase. This would seem to be borne out by the fact that between 1904 and 1909 the income from sales and rentals of lamps and appliances increased as follows:

1909	$7,043,390
1904	4,249,581
Increase	$2,793,809 or 65.7%

The census report contains further figures comparing the growth of the gas and electric industries as follows:

	1909.	1899.	Increase.	Per cent.
Number of gas plants	1,296	877	419	47.8
Gross income from sales of gas	$138,615.309	$69,432,582	$69,182,727	99.6
	1912.	1902.	Increase.	Per cent.
Number of electric stations	5,221	3,620	1,601	44.2
Gross income from sales of electricity	$286,980,858	$84,186,605	$202,794,253	240.9

Mr. W. T. Barbour, President of the Detroit Stove Works, in a paper at the Boston Convention, gave figures comparing the number of coal stoves and gas ranges sold each year between 1900 and 1909, and he has since brought the figures up to 1913, and been kind enough to allow us to use them.



Showing Coal Ranges and Gas Ranges Sold During 1903 to 1913.

During the 14 years 1900 to 1913, there were sold:

Coal stoves	47,163,000
Gas ranges and heaters	7,751,000
Total coal and gas stoves	54,914,000

This means that of all stoves sold only 14.11% consume gas.

The 1910 census report shows the number of families in the United States:

1910	20,255,555
1900	16,187,715
Increase	4,067,840 or 25.13%

The number of stoves sold (coal and gas) between 1900 and 1910 was:

Coal	38,665,000
Gas	5,083,000
Total	43,748,000

This shows an increase in stoves of 43,748,000 against an increase in number of families of 4,067,840; the increase in stoves, about ten times as great as the increase in number of families. The sale of gas consuming stoves increased 5,083,000 against an increase in number of families of 4,067,840; the increase of gas stoves a little greater than the increase in number of families.

From statistics in Brown's Directory, it is found that the average yearly consumption per gas range connected is about 15,000 cubic feet. Therefore, if every family in the United States in 1910 (20,255,555) was on a gas main and could be brought to use a gas range, the annual output for domestic cooking would be 303,833,325 M cubic feet; which at an average rate of $1 per M cubic feet, would give an annual income of $303,833,325. In 1909 the gross income from gas sales in the United States was $138,615,309. of which, perhaps, 50% or $69,307,654, was from fuel sales. This means that there is still about $234,525,671 worth of domestic fuel (range only) business for the gas man to obtain.

Gas fuel has only one large competitor, coal; the minor ones, oil, gasolene, etc., not being very active. Electricity is coming in but is at present out of the question except for the wealthy. Though the electric campany is a strong competitor in the lighting end, its success being measured by our resistance, we have an enormous field along the line of domestic fuel appliances. It is

(*Continued on page 74.*)

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Industrial Chemistry.

The detailed accounts of the origin of the world's great commercial successes and epoch marking advances are as interesting reading as "best sellers." Two achievements in which we are particularly interested directly are the coal-tar dyes and the incandescent gas mantle. On the former we have given you some interesting statistics in late issues of the Journal; and Dr. Miner's address in this number outlines a few of the steps that have made the gas mantle a success and put it in the catagory of necessities. It is also neutral to remember that both of these are founded on German research chemistry, and that not a few new ideas in gas making come from the same source.

Public Utility Bonds and National Banks.

The annual report of the Controller of Currency shows that the national banks of the country had increased their holdings of public utility bonds by something over 11% during the year ended June 30, 1914; and that the total of these bonds represented about 11% of their total bond investments. Not only did public utility bonds show the largest percentage of increase of any class of bonds, but they showed the largest gross increase, approximately $21,000,000. Bank holdings of Government bonds increased slightly over 1%: State, county and municipal bonds increased only 0.1%, while railroad bonds and foreign securities showed decreases, the former of 1%, and the latter of over 27%. The accompanying table shows the bond holdings of 26,765 banks:

Classification of Investment Securities Held by Banks on June 30, 1914.

	Total Holdings.	Public Utility Bonds.	Per Cent. Total.
State banks (14,512).....	$388,300,000	$50,800,000	13.70
Mutual savings banks (634)	1,855,500,000	83,600,000	4.50
Stock savings banks (1466)	1,148,700,000	4,900,000	0.427
Private banks (1064).....	16,300,000	1,700,000	10.42
Loan and trust companies (1564).....	1,261,300,000	224,700,000	17.82
National banks (7525)....	1,914,800,000	218,200,000	11.40
Total (26,765).....	$6,584,900,000	$583.900,000	8.87

The last 6 months has undoubtedly increased bank investments in utilities and this should be a help in disposing of new issues.

Mid-Winter Meeting, New Jersey State Gas Association.

On Tuesday last over 100 members of the New Jersey State Gas Association met at Glassboro and inspected the modern plant of the New Jersey Gas Company. This is one of the most up-to-date high pressure plants in the East, and the large buildings and spacious grounds were as much a delight to the visitors as they evidently are to Manager Hoy.

Through the kindly assistance of Mrs. Hoy and the ladies of Glassboro, the visitors were given a delightful luncheon at the Glassboro Auditorium, in the main room of which the Association meeting, at 2 P.M., began, with President Butcher in the chair. The painstaking and optimistic Secretary, Mr. Potter, was relieved of the roll-call and other preliminaries, and the Rev. Charles Dubell, pastor of St. Thomas Church, Glassboro, welcomed the gas men to the city.

Then the paper, "What is Being Done by Manufacturers of Appliances to Encourage the Use of Gas as a Fuel," by Mr. Stanley Grady, of the Roberts & Mander Stove Co., Philadelphia, was read by Mr. G. Edward Bartlett, owing to Mr. Grady's absence on account of sickness at home.

Mr. Bartlett achieves so much success reading other people's papers that it is to be hoped that he will soon be heard from in the first person singular. Mr. Grady covered briefly the general points that are familiar to most of us, but their application brougbt out what gas men are not doing.

The discussion was opened by Mr. J. M. Brock, who said that manufacturers receive but little encouragment from gas companies to develop new appliances, and cited a number of instances where good articles had been put on the market, but the companies had not purchased them. Messrs. Jones and Hoy took the gas companies side of the argument, not that they could be accused of being overzealous. Mr. H. T. Owens asked if any gas men present were selling gas percolators or chafing dishes, and not one outside of the Public Service answered "Yes." Mr. Bartlett sketched briefly the troubles of the manufacturer who tried to co-operate with the gas company. He said that after he furnished the companies enough advertising matter to keep their furnaces going most of the winter, they wanted the manufacturer to visit the plant and sell the goods for them. Mr. George Harris stated that his idea of co-operation was for the company to demand the best quality obtainable, as the use of the best goods was the surest way to provide good service. Mr. Franklin declared that the small table gas appliances were not satisfactory, and Mr. Bartlett rejoined that his experience had been that the same was true of the electric appliances. Mr. Conroy defended the gas company who bought only one line of goods, as it standardized their appliances.

The second paper, "Is the Sale of Gas-Electric Fixtures by Gas Companies Desirable?" read by the author, Mr. R. F. Pierce, covered most of the reasons why it is desirable, the principal one being that if gas had a chance it would win out. He was followed by Mr. Harraden who, in a lengthy argument, backed up most of Mr. Pierce's contentions.

Mr. Owens presented a plan covering all types of fixtures equipped for both gas and electricity, so designed that gas would have an equal chance with electricity.

Mr. L. B. Barrett said that during the past year practically all of the new houses in Camden were piped for gas, and that it was one of the few cities where electric wiring was the exception instead of the rule. Out of 788 houses built in 1914, 529 were piped only, 251 were piped and wired, and but 8 wired only; so pushing combination fixtures there would be helping our competitor.

Mr. Hamerstrom followed with a strong plea for more consumption and better lighting on existing outlets to insure the lighting business of the future from inroads.

Mr. Pierce closed, and the meeting adjourned with appropriate expressions of appreciation for Mr. Hoy's hospitality.

Philadelphia Gas Meeters Hold Banner Meeting.

The announcement said that the meeting on Tuesday, January 26th, would be "one large evening;" it was. The Meeters met at the Hotel Adelphia, and to choose the words of Chairman Bartlett, they went to Jersey and "brought them back alive." Who? The Jerseyites direct from the New Jersey State meeting, and they had added attractions of the headline variety.

When Mr. William H. Gartley speaks, men listen; to-night they also laughed, for while he spoke on the "History of Gas Manufacture," he told of many humorous happenings during his 30 active years. He started way back in Clegg's time and then jumped right up to what he called the Frank Moses time, which means the development of the Lowe apparatus in its various forms. Mr. Gartley's serious moments were notable for even balanced and well chosen words which should encourage the coming man to realize the human element in engineering, as exemplified in the "Gas House Tarrier."

There were others there to bid us welcome; the self-appointed Chaplain, Rev. Dubell; President Butcher of the New Jersey State Gas Association, and Mr. L. R. Dutton, President of the Pennsylvania Gas Association and Grand Commissioner of the Gas Meeters. There was also music—real music—and entertainments of the cabaret kind. It was "one large evening."

SPECIAL ENGLISH CORRESPONDENCE.

Monthly Letter From Norton H. Humphrys, Salisbury, England.

A FIXED CALORIFIC STANDARD.—A NEW USE FOR GAS COKE.

There does not appear to be any great hurry, on the part of gas undertakings, to come under the wing of the calorific standard in preference to the photometer, seeing that only eight companies are seeking Parliamentary Authority in that direction during the session of 1915. This may arise, not so much from indifference to the calorimeter as the stress of other matters of more importance for the moment, and the fact that on account of the expense and risk of having to encounter opposition, it is not usual to go to Parliament until absolutely obliged to do so. Municipal authorities have a powerful combination to look after their legal interests, and it is not a pleasing prospect to be landed into the costly and risky process of fighting an Association having unlimited resources at its back. But in view of the comments I have already made on the absurdity of fixing two different calorific standards, or a margin before penalty clauses come into force, it is interesting to notice that four of these companies are applying for a fixed standard. The model clauses provide a standard of 540 B. T. U., but with a margin of 7½%, and in some cases as much as 12% has been granted. While the normal standard is 540, the actual figure at which penalties commence, on the lowest margin, is 499.5, For all practical ends and purposes the standard is the lower limit—499.5 In estimates of the heating value of town gas that figure will be used, and if the higher one is adhered to in practice no credit will be given for it.

The public will not generally accept as fact that a company bound to only 500 is voluntarily supplying 540. Some will flatly refuse to credit it, and others will say "more fools they." So the four companies named very wisely come to the point by proposing a 500 B. T. U. standard with no margin. It is difficult to understand why this straightforward method of dealing with the question was not adopted in the first place. There is also the disadvantage that a 7½% or a 12% margin carries with it the assumption that gas engineers are unable to control the composition of their gas to a corresponding extent, which is not a compliment to their technical ability. And as a matter of fact it is well known, now that inverted gas burners are so largely used, that above all things the gas must be uniform in quality from day to day. Give the consumer a low standard—to my idea 500 B. T. U. is too low, in the interests of all parties. If a district was supplied with gas varying in composition from time to time within limits of about 10%, I venture to say that a large and thick complaint book would be indispensible in the office.

There is also evidence of the infiuence of public affairs. I have remarked that the existing gas legislation does not recognize or contemplate such a contingency as an European war conducted with the reckless slaughter and devastation that is rendered possible by the resources of modern civilization and refinement, and that in some respects, inconvenience has consequently arisen. Now we find one undertaking seeking powers to enable the directors to contribute to any National emergency fund, or to infirmaries, hospitals, convalescent homes, or sick fund within their district. And to grant pensions, or gratuities in the case of any employee killed, wounded or incapacited by war, to the sufferer or to his dependents or to make arrangements witb insurance companies for that purpose. Others have reference to the issue of Capital, and follow the lines I have already indicated. Stand-by clauses and co-partnership regulations are a usual feature; and in one instance the supply pressure is to be raised from $\frac{8}{10}$ths to $\frac{10}{10}$ths. Seeing that consumers generally require about $\frac{9}{10}$ths, it cannot be said that this proposed alteration errs on the side of recklessness.

There are good prospects of an extensive demand for gas coke for use as a fuel in connection with steam road tractors. At a recent meeting of the shareholders of the National Steam Car Company, an undertaking that runs a large number of steam motor buses in the Metropolitan district, the Chairman in the course of his address, made reference to investigations that had been conducted towards the employment of a cheaper fuel, which he was glad to say had been brought to a successful termination. One of their busses had been adapted to use ordinary gas works coke as fuel instead of paraffin, at one-third the cost. But between this achievement and the actual running of a bus in service with the new fuel, a considerable interval was unavoidable, owing to the prolonged tests both chemical and mechanical, which were conducted by the experts of the Chief Commissioner of Police, in order to satisfy his requirements that a bus using coke fuel should be in every way suitable for service in the streets of London. After such a severe ordeal, the coke motor bus has been approved for service, one had been running for some time, and a careful observance of its performances under service conditions indicated a very important future for this type of motor in connection with passenger service. The suitability of this motor for the economical transportation of merchandise was also kept in view, and at the Whit Monday parade of the Commercial Motor Users Association one of their coke motor busses was exhibited for the first time and awarded a silver cup. Trial orders for lorries soon followed, and a London gas company, after making a lengthy test of one, ordered six. Some motor transport experts had regarded the remarkably low results as too good to be true, and the company had therefore decided to obtain an independent test by submitting a coke motor to the Expert and Technical Committee of the Royal Automobile Club for the purpose of an official trial, and to obtain a certificate as to the actual performance. The test was carried out in July with the result that the fuel consumption recorded at the official trial was more than 25% better than they had previously claimed, and since that date they had been notified that the Expert and Technical Committee of the club, having considered all the tests made under their auspices during the year ending 15th October, had selected the National Coke Motor trial as the most meritorous performance, and awarded the company the handsome trophy that was now on view in the room.

The certificate referred to sets out particulars of a run from London to Brighton and back. The coke used was a fair specimen of ordinary gas works coke, passed through a 2-inch mesh screen and over a 1-inch. The calorific value was 12,468 B. T. U.; moisture 1.45%; ash 11.4%. The boiler was of the water tube type, and the feed of fuel automatic. The engine was 2-cylinder compound; cylinders 3½ and 4¾ by 4 inches; gear ratio, 7.4 to 1; diameter of road wheels, 3 feet 5 inches, and weight of lorry, 3 tons 16½ cwts. The total weight, including load, was 14,728 pounds; distance run, 109½ miles; ayerage running speed, 12 miles per hour; 403 pounds of coke were used, average 1.68 pounds per mile traversed; 0.56 pound per ton-mile gross, or 1.335 pounds per ton load carried. Time taken to raise 250 pounds pressure steam, starting cold, was 21½ minutes. Gallons of water used, 7⅞ each journey, or 1.5 per mile. Weather dry and roads good.

As compared with Welsh coal the fuel costs are only two-thirds, and a coke-burning grate can be fitted to any type of steam motor. The space between the fire bars are wider than usual with coal. It is evident that gas companies, in a way of business large enough to call for the use of road motors, will do well to encourage the National Steam Car Co. by placing orders with them for coke-fired motors.

If coke can compete successfully with coal and with liquid fuels on the small scale, why should it not do so in larger operations? It may be urged that as far as road traffic is concerned, coke enjoys a special advantage as being a sootless smokeless fuel, that would, apart from other reasons, secure its preference. This is quite correct and no doubt served to direct attention to the leading gas works residual in the first place; but it will be observed that no credit is taken on this score in the official test. It therefore follows that coke may be used with advantage, on economical grounds, in localities where the smoke nuisance is not of pressing moment. In this respect it should be noted that smoke and soot are tolerated, as one of the evils that must be endured, in many districts where smokeless fuel would be highly appreciated. The trade and well being of a town may depend largely on an extentensive factory, that, besides smoke and soot, brings in its wake employment for hundreds or thousands of hands, and a large weekly wage sheet, the bulk of which finds its way into shops in the immediate locality. Under these circumstances a lenient eye is directed to the clouds of black smoke from the big chimneys, because any attempt at complaint or forcing prevention might lead to annoyance and a transfer of the whole or some important proportion of the factory to some other less fastidious district. Under these circumstances, the only inducement to smoke abatement is that

which touches the pocket. Some manufacturers have candidly remarked that smoke prevention did not interest them unless it was a means of saving money. Gas companies having stocks of coke on hand will do well to see that the certificate of the Automobile Association, being a free and independent advertisement as to the economy of coke as a means of raising steam, is prominently presented to the notice of all users of power in their district.

In this connection some reference may be made to a series of articles on coke for steam raising purposes, published a few months ago in the *Journal of Gas Lighting*, as they deal with a number of factors on which depends the success of coke as a boiler fuel. The writer of them prefers to remain anonymous, and gives the results of his experiences in approaching 42 boiler users, out of which number no less than 12 became regular users, and that at the rate of 10,000 tons a year, to say nothing of a fair prospect of business from some of the others. The next striking point about this experience is that gas companies who have gone for the small consumers of coke and let the large ones alone, are indeed taking care of the pence and leaving the £5 notes to be blown out of the window—10,000 tons a year represents a very large number of orders reckoned in 28-pound paper bag units, or in 5 cwt. or 10 cwt. lots. It represents an enormous amount of advertising, canvassing and circularizing, before a single order is received at the office, and a considerable outlay in booking and delivering orders. Much of this outlay could be saved by the simple expedient of interviewing say 50 boiler users, and arranging for working tests. There is the more reason for this, seeing that in connection with the household use of coke there is probably no more energetic competitors than the people who make it, and who are continually urging the advantages of gaseous as compared with solid fuels for cooking, heating water, and warming apartments. The household trade is variable according to the state of the thermometer, and almost nothing during the summer 6 months of the year. The steam boiler is not only a large consumer, swallowing up more coke in a 10-hour working day than a household would consume in a year, but it has the advantage peculiar to the gas cooker, that of being independent of climatic conditions. Except at times of industrial upheavals the consumption will be regular, 6 days a week summer and winter alike. The writer goes very fully into details, such as size, quality, percentage of moisture and ash, instructions in firing, forced draught and mechanical stokers, causes of failure, disadvantages, etc., in a thoroughly practical manner. The individual who is told off for the work of looking up boiler users must, of course, make himself thoroughly competent, because the best possible advertisement is a successful test, and on the other hand it will be difficult to get over the disadvaniages attendant upon a partial failure. Having read up all available information, he should follow up by some practical tests at one of the gas works. It is desirable that he should have some experience as regards retort house furnaces, from which an intelligent observer can gather many useful hints as to proper methods of working any kind of furnace with coke.

Naphthalene as a Motor Fuel.

Naphthalene is one of the suggested practicable solutions of the motor fuel problem and is an ingredient in most of the gasoline substitutes offered. The great advantage of naphthalene is its cheapness, the objection to its use is that it is solid at ordinary temperatures, so if not dissolved it has to be melted before it can be passed to the curburettor. The heating can be done by jacketing the fuel reservoir and downtake pipes with the exhaust gases, or circulating water from the engine jacket. The crystals may be placed in a gauze basket so that melted material may escape readily. It is necessary to run on gasoline till the naphthalene container and passages to the carburettor are heated, usually 10 or 15 minutes. Naphthalene has a calorific value of about 17,400 B.T.U. per pound; and, owing to its high carbon content (93.7%) requires a large volume of air to complete combustion. Experiments in the use of this fuel in a Renault taxi driven by a 2-cylinder 12-horse power engine showed an average fuel consumption of ½ pound per mile in a round trip of 65 miles at about 22 to 26 miles per hour. The exhaust was smokeless, and no cylinder deposit formed. In a 72-horse power Schneider naphthalene locomotive naphthalene is melted by water from the cylinder jackets. Any steam formed rises through cab to a double-bow roof radiator, so arranged that the condensate flows back into the circulating system. It has proven an efficient tractor and suitable for use in city streets.

(*Continued from page 71.*)

Domestic Fuel Appliances from the Cunsumers' Point of View.

reasonable to suppose that every family does cook by one means or another, and it is, therefore, the work of the gas man to see why gas is not the means used, if along or accessible to his line of mains.

The fact that in 14 years (from 1900 to 1913) there were 39,412,000 more coal stoves sold than gas ranges, should make the gas man inquire how many were sold where gas could have been furnished.

Statistics Compiled from Brown's Directory, Showing the Increase of Domestic Fuel Business from 1908 to 1913, for 60 Gas Companies in New York, outside New York City.

Item.	1913.	1908.	Increase.	Per Cent.
Population supplied	2,016,650	1,748,227	268,423	15.35
Meters connected.....	301,977	209,477	92,500	44.16
Annual fuel sales, M....	2,696,006	1.600,234	1,095,772	68.48
Ranges and stoves con'ed.	175,464	108.422	67,042	61.83
Consrs. per 100 pop.....	15	12	3	25.00
Ranges and stoves per 100	9	6	3	50.00
" per 100 consrs.	58	51	7	13.73
Fuel sales per capita,cu.ft.	1,336	915	421	46.01
Fuel sales per meter	8,927	7,639	1,288	16.86
Fuel sales per stove.....	15,365	14,759	606	4.11

NOTE—Line 3—40 per cent. of total sales in 1913. 33 per cent. in 1908.

These statistics show that 58% of the consumers use ranges or cooking stoves of some kind, leaving 42% still to be approached for fuel business. In 1913 42% of the consumers (meters connected) was 126,830; and average annual sales per range or stove 15,365 cubic feet. If these 126,830 could be convinced of the advantages of gas fuel, the annual consumption would be increased by 1,948,742,950 cubic feet—an average for each of the 60 companies of 32,479,049 cubic feet, or at a value of $1 per 1,000, an average of $32,479.04 added income each year for each company. Assuming 1,296 companies (1910 census) the total additional income on this business in the whole country would be $42,092,835.84.

These figures are of course largely estimated, but the argument is sound and give an idea of the large undeveloped sources of income from domestic fuel, *not by getting new consumers* with their attendent investment charges, but by obtaining fuel business from present gas users, without further investment except, perhaps, for additional plant capacity, which nearly always earns good interest, while additional service investment frequently bring none at all.

Progress Made by Competitors.—The latest competitor with gas as domestic fuel is electricity, and although it cannot yet fight very actively against gas fuel, the electric man is alive, and it behooves the gas man to become so.

The principal obstacles in the path of electricity for cooking are as follows:

1. Electrical cooking devices are not made as efficient and easy of operation as present day gas ranges.

2. The initial and maintenance cost of an installation is out of reach, except for the wealthy classes. A gas range is simple in construction, and may be used constantly for several years with very small expenditure for renewals or repairs, whereas in the present electric range the heating elements have to be renewed quite frequently, if submitted to the equal usage.

3. At present, electric rates can hardly be made low enough to compete successfully with gas. A few people are willing to pay for the novelty of cooking with electricity, but there are more who prefer to continue with gas which gives them better results for less money.

Gas companies receive a large portion of their fuel business from the middle or wage-earning class, and with present rates and devices the central station cannot hope to touch that business. If, in the future, more efficient appliances and reasonable rates are provided, another obstacle for the electric man to overcome will be public opinion, and if the gas man gets to work now, this obstacle will be almost insurmountable. Gas has the start by a number of years, has always given a high degree of satisfaction, and when a customer is perfectly satisfied with his gas appliances, it will take a great deal of demonstration to make him change a sure thing for an uncertainty. Electric companies generally are introducing special rates to induce consumers to use electric cooking and heating appliances, and although at present gas cooking is cheaper, there is no telling how soon an electric stove may be invented which will cost less to operate than a gas range.

It may be of interest to quote some of the things the electric man has been doing. At Worcester, Mass., an 18-suite apartment has

electric cooking appliances exclusively, and not a foot of gas pipe in the building. The electric cooking is on a 10c. rate, working downwards with consumption, against gas at 75c. In Hartford, Conn., extensive experiments are being conducted in the electric heating and cooking field, and very attractive rates are offered.

At the Electric Show in New York an electric grill and tea room served about 600 people a day, and was a particularly good advertisement for electric cooking. On the new battleship "Texas" the cooking is done entirely by electricity.

The Electric Company in St. Louis is endeavoring to displace gas trons. They allow consumers $1.00 on the price of an electric iron if they being in their gas iron. In Rockford, Ill., is a house equipped ih roughout with electric devices for demonstration purposes.

The Chicago American League Baseball Club has an electric range at the ball park. In London, England, there are numbers of restaurants advertised as "Electric," where food is cooked entirely by electricity. These are very well patronized, and are apparently a paying proposition. At Pocatello, Idaho, passengers on the Oregon Short Line Railway will be served with electrically cooked meals in the new station restaurant. If the installation proves successful the use of electricity will be extended to the railroad's hotel service at other points.

Among electric domestic appliances made are:

Domestic Ranges	Tea Kettles,
Circulation Water Heaters,	Disc Stoves,
Radiators, heating devices,	Hot Plates,
Irons,	Grids,
Shaving Cups,	Toasters,
Milk Warmers,	Chafing Dishes,
Heating Pads,	Coffee Percolators.

If electricity makes itself felt in the fuel end of the gas business, it will be through the attractiveness of the appliances and not their practicability and economy. Therefore, let us make and sell gas appliances which are not only practical and economical, but also attractive, and which the purchasers will be proud to show to their friends.

Suggestions for Meeting Competition, Holding Old Business and Securing More New Business.

The problem that confronts the gas business is not only how to increase the sale of domestic fuel appliance, but how to direct our efforts to increase consumption on present installations. The gas range is a stepping stone to the "all gas kitchen," and often leads to industrial installations. While it has been developed to a very high degree and is found in the majority of homes, it is to this appliance, in the congested tenement districts and in the more spacious dwellings in the suburbs we must give that constant attention in the future. Competing fuels must be handled aggressively and systematically, and if we would eliminate them we must furnish a satisfactory substitute. The "all gas kitchen" is recognized as the model kitchen, yet much missionary work is necessary if we would secure more of this business. The question of price may or may not enter into the calculations. Often too much is made of the low operating costs and not enough of the convenience and efficiency of the appliance. With the average person it is necessary to appeal to the pocketbook, but a great many are willing to pay for convenience and service and cheap service is undesirable. There are many conveniences that cannot be valued in dollars and cents. The patronage of the "taxi" instead of the "trolley" is only one illustration of what many are willing to pay for service. By demonstration and education we ean raise the valuation of domestic fuel service to a point which will compel the attention of the fuel consuming public. We can create a desire for this service by carefully prepared and properly conducted educational campaigns. Good booklets covering local conditious will do much to popularize domestic fuel appliances. The booklets should be illustrated with photographs of local installations. Photographs of the "all gas kitchen" should be shown compared with a coal range kitchen, The method of transformation should be carefully explained, so that it will be clear that it is possible to create one from the other. The gas water heater could, in the same way, be compared with the tea kettle method. For example, contrast the number of motions made in boiling water in a kettle and the limited service, with the ease of operation and unlimited service of the gas water heater. The booklets furnished by appliance manufacturers are valuable, but the majority dwell on the advantages of particular appliances over other makes, rather than the advantages of gas over other fuels. We are convinced that gas fuel is cheaper, more efficient and far more convenient than other fuel; so let us pass the conviction along and never let pass an opportunity of enlightening the prospective consumer as to the advantages.

Our educational work should be extended beyond the consumer to the architect and the builder. If the designer or owner of an apartment has up-to-date furnishings in his own home, including a model kitchen, it will not be so difficult to induce him to specify these conveniences for his clients or tenahts. Much good work has been done with architects, and we find in many localities that they are specifying steam radiators in the kitchens and, in nearly all cases, fuel lines for gas ranges. We should make special efforts to show architects and builders the necessity of providing outlets for portable gas heaters in the cheaper homes, and the installation of gas fire places in better classes of buildings.

The plumber may be a big factor in procuring "all-gas kitchens." Coal stoves wear out and must be replaced; or perhaps one does not give satisfaction for some reason or other. The plumber is called in to relieve the situation, and he should advocate the installation of the "all-gas kitchen," which would not only mean the order for a range, but also a water heater and a radiator or kitchen heater. Consequently he gets a larger job, and more pro fit than if he simply replaces the old coal range with a new one. He is also advancing up-to-date methods and conferring a favor on his customer, who will appreciate the convenience of an "all-gas kitchen." In the majority of cases the plumber's advice to the customer is taken. The plumber is also in a position to place automatic water heaters as often the customer complains to him that the supply of hot water is insufficient. Here is the remedy, and we should see to it that he is supplied with the proper information concerning their installation, etc.

Many gas companies make trial installations of "all gas kitchens" with profitable results. Companies would find it worth while to make such installations in the homes of the architect and the builder. When the "all gas kitchen" has once been decided upon, the gas companies should secure the co-operation of the builders in selecting the proper appliance. If left to the builder it might result in an inferior installation which would tend to discourage the universal adoption of the "all gas kitchen." Opinion is divided as to the advisability of supplying appliances to builders at or below cost. This is a matter for each company to decide, but all are agreed that the time to secure the business is before the contract has been awarded, or at least while the building is in process of erection.

Whenever poss!ble, gas companies should have a model kitchen in their display room, fully equipped and attractively arranged. Demonstrations of this kind go a long way toward converting the skeptical. Photographs of successful installations and letters of commendation from satisfied customers will often be the means of closing a sale. In houses where there is no central heating plant, and where a straight "all gas kitchen" is not practicable, we should advocate a kitchen heater with kindler, which is used to burn garbage, refuse, etc., and to heat the kitchen in cold weathsr.

That free inspection is not more generally adopted by gas companies may be due to regarding it as an unnecessary expense. If regarded in this light, its advantages may be questioned. A paid sales force is kept busy securing orders for new installations, many of which require additional investment for piping, meter or service, and which, when completed, will not yield a greater revenue than could be obtained from some similar appliance already nstalled but not used because not working satisfactorily. The timie of an inspector to reinstate an appliance is no greater than that required to make a sale; in many cases it is much less. The benefits to the company are instantaneous and without additional investment, and valuable as an advertisement of good service. Inspectors would not only put appliances in proper condition, but could turn in prospects, many of which would develop sales. Some companies provide free inspection of instantaneous automatic water heaters, and possibly include some other special appliances, but only a few recognize the value of a general consumers' appliance inspection. Free inspection seems inevitable. It has been predicted that it will be in the near future a factor in regulating the price of gas. Dollar gas with free inspection is more desirable than cheaper gas without inspection.

The use of the various domestic gas appliances, water heaters, laundry stoves, gas irons, incinerites, sterilizers, heaters and other accessories featured by our competitor should be constantiy encouraged. Types of ranges which feature the broiler should be recommended and every effort made to get the gas range in action for every process requiring fuel.

In selecting appliances for sale, we advocate strict adherence to articles of good quality, and to those showing high efficiency under test; at the same time care must be used to select such as will appeal to customers, not only because of usefulness, but also by general appearance.

The watch-word of our business is "*service*," and our idea should be to serve our customers, in a way agreeable to them, at the same time maintaining a strictly business attitude in the handling of the affairs of the company.

The new business department is the branch of our business that reaches out among the people with the intention of selling them gas and appliances to use it, and the representatives of this department get in closest touch with the customers. These men carry the company policy to the kitchens and workshops of customers, and there is perhaps no greater responsibility vested in any gas company employee than that imposed on outside representatives. They should appreciate the confidence reposed in them by the company, and if they do all in their power to set a high standard of personal ability in transacting the company's business, by being manly, courteous, truthful and businesslike, they will soon gain the confidence of the consumer. This once obtained, should never be abused. Their success, from the company's standpoint, demands that they bring in orders to supply gas for new customers, and for appliance from existing ones. Their success, from the customer's standpoint, is that the orders given are promptly and carefully executed, and when completed serve the desired purpose.

Subways for Pipes and Wires.

The subject of better accommodations for public utility pipes and wires in the down-town districts of Chicago has been studied by a committee of Aldermen and representatives of the Chamber of Commerce, and investigated for them by a firm of engineers.

The general purpose is to provide better locations for the complicated pipe and conduit systems under the congested streets, and to eliminate the continual disturbance of the street paving for repairs and inspection. The disturbance interrupts traffic and seriously affects the life and condition of the paving, with loss on the original construction and continual patchwork repair. The proposed underground railway system also has an important bearing on the question of the underground utility service.

The report of the engineers shows that the district bounded by Lake Michigan, the Chicago River and 12th street, has 21 miles of street with 120 acres of pavement surface, valued at $2,000,000; and under these streets 220 miles of utility pipe and conduit lines, including those municipally owned, and not counting an equal or greater mileage of service connection. The pavement openings for the maintenance and extension of these number from 2,000 to 4,500 per year, and the aggregate area of these openings in 1913 was over 10 acres, equivalent to a 48-foot street more than 2 miles long. It is estimated that the occupancy of the district will increase at least 100% within 15 or 20 years and ultimately 300 or 400%. All the available space for pipes is at present occupied, but with orderly arrangement it would be sufficient for the ultimate requirements.

The underground structures are given as follows: Municipal—water pipes, 34.6 miles (including lines in alleys); sewers, 23.6; city wires, 5.3; total, 63.5. Private corporations—Peoples Gas Light and Coke Co., 94.9 miles; Commonwealth Edison Co., 25.3; Chicago Telephone Co., 24.2; Western Union Telegraph Co., 5.7; Postal Telegraph Co., 6.5; total, 156.6. Grand total, 220.1 miles of pipes and conduits in 20.8 miles of street. Many streets have five or six, and some as many as nine gas pipes, even the narrow streets having from two to four, due to the fact that the present gas company is a consolidation of several former companies. The sewers are on the combined system, and as most of them were built many years ago, are of insufficient capacity to drain the district and carry off the storm water during heavy rains. An entire new system of sewers, separate for sewage and rain water, is advocated by the Engineer of Sewers. Some streets have as many as 18 separate sub-service lines, run in a most complicated way, as new ones have had to avoid previous construction. At street intersections there is further complication by intersecting lines and vaults for valves and hydrants, some intersections having as many as 41 manholes.

The pavement torn up to allow access to the underground utilities was equivalent to 3% of the street mileage in 1913, and 9% in 1914, and 57 and 72% of this was for repairs in these two years. Of the total torn up the municipally owned utilities were responsible for 35 and 32%, respectively.

Foreign experience indicates that utility galleries or subways for streets where the utilities are already installed are not financially practicable, but that such galleries are warranted when new streets are opened. The practice abroad is for the municipality to build them, renting space to the corporations. London has 8 miles of galleries and 50 years' experience in their operation.

Chicago conditions differ from those of London in the greater height of buildings, and the larger use of utilities. All the streets in this particular district must be opened in the near future for the construction of a new sewer system, and probably for a high-pressure fire protection system. A number of them must also be opened for the building of transportation subways, which would be accompanied by extensive changes in existing structures.

The report points out that in the end the people must pay for adequate accommodation for all utilities, and that a co-ordinated plan for all will give the most economical result. If utility galleries are to be financially possible they must permit saving sufficient to warrant the cost.

Saving would include: (1) Cost of street openings, now amounting to $200,000 to $400,000 annually; (2) reduction in cost of pavement maintenance; (3) longer life for pavements; (4) reduction in operating cost of utilities; (5) reduction in cost of future extensions; (6) reduced leakage of water and gas; (7) the value to the public of good streets and decreased interference with traffic. The cost will include fixed charges on the following: (1) The expenditure for galleries; (2) cost of moving the pipes and wires to the galleries remembering that the greater part of the present investment would be lost; (3) cost of cutting and reconnecting service lines. The actual costs and savings can be determined only by further investigations, and a rough estimate indicates that the reproduction cost of the existing sub-street utilities (public and private) is between $10,000,000 and $13,000,000.

The saving in cost by excluding the sewers and gas mains was considered, the former because requiring very infrequent tearing up of streets and the latter on account of danger of explosions; but the saving would not be very great, and long experience in London indicates that with proper precautions and ventilation there is little liability of explosion. The construction of underground galleries or subways for utilities has been discussed in a number of American cities, but none have been built, except on one short street in New York, and it is not occupied.

There could be either a subway in the center of the street, or one near each curb line, the latter arangement considered the best. In many cases the alleys might be used, but as a rule these are not thoroughfares. The use of subsidewalk space for galleries also has advantages, and while much of this space is occupied by abutting property, in about 10% of the Chicago down-town district the city owns the streets to the property lines, and issues revocable permits to the occupants. In the remainder of the district it has an easement to the property lines for street purposes, and it has been held by legal authority that the use of sub-sidewalk space for utility subways constitute legitimate street use.

The conclusions are that further study and investigation are necessary before any definite plans can be adopted. If it is not practicable to at once install a comprehensive system of galleries in the down-town district, attention should be given to successive installations in connection with other improvements, such as the Michigan Boulevard link, the 12th Street widening and the transportation subways.

Finally, the report says, "as an economic proposition, the saving to the utilities by the use of subways, plus the value of the subways to the public in relieving present inconvenience, must be sufficient to pay the fixed charges and maintenance on a system of subways, plus the cost of placing the utilities' property in the subways."

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by ROYAL E. BURNHAM, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,123,232. Gas Washing. H. A. Brassert and C. J. Bacon, Chicago, Ill.

1,123,298. Globe Holder for Lamps. F. J. Humphrey, Kalamazoo, Mich.

1,123,349. Igniting Device for Gas Burners. B. Morgan, Newport, R. I.

1,123.489. Gas Burner. G. J. Comminos, Pittsburgh, Pa.

1,123,540. Gas Meter. T. Jackson, New Cross, London, England, assignor to himself, and to A. Ramsay, Folkestone, England.

1,123,648. Gas Lamp. E. E. Allbee, Arlington, N. J., assignor to Safety Car Heating & Lighting Co.

War on Coal Ranges.

Mr. W. M. Stack the General Superintendent of the Hyde Park Gas Company, Scranton, Pa., has a "War Special" which, to the casual observer, is all out of season and all out of reason. But perhaps that is why the results at Scranton are in a class by themselves.

"War Special" Campaign Squad.

In this concentration against coal ranges in a coal mining district, a cabinet range for $18.50 and 1,000 of them is not a Monday morning bargain sale, but at the rate they sell stoves in Scranton this offering will not last more than 3 months. The stoves will be sold in the homes and not in the showrooms. A special squad of "gas-rangers" well trained and with the goods, will make a house-to-house canvass.

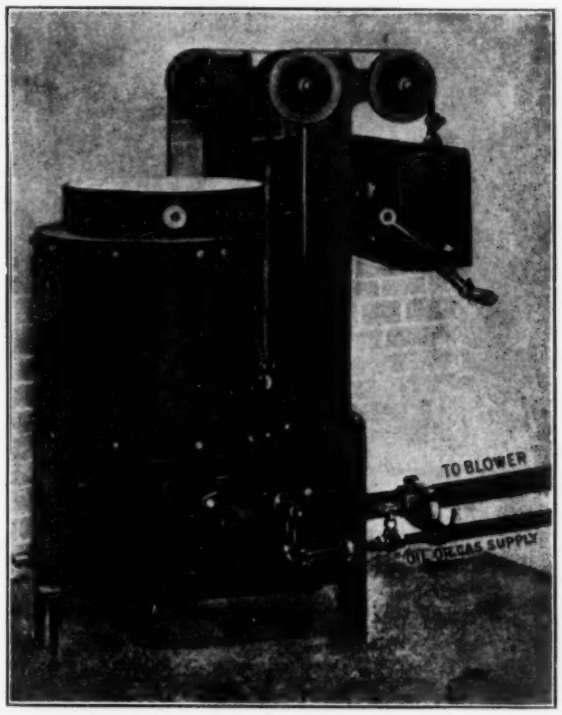
Scranton, Pa., Office, Showing Arc Lighting.

The second cut shows the Scranton office with its 20 three-mantle Humphrey Arcs, on massive ornamental brackets. They are controlled by a mercury valve, and lighted and extinguished by a lever cock in the salesroom.

This is an example of the kind of out-door lighting that advertises the business generally and the advantages of gas arcs in particular.

New Methods and Appliances.

DRAW CRUCIBLE FURNACE.—The accompanying illustration shows a type of draw crucible furnace, designed for gas fuel, adapted to melting and refining where it is desired to pour from the crucible in which the charge is melted.



The furnace is cylindrical and constructed in two parts, the lower one the combustion chamber and the upper the crucible chamber. An air tight seal is formed between them by the crucible chamber fitting into the combustion chamber when the furnace is closed. A refractory stool or crucible rest is placed in the base of the crucible chamber, on which are mounted column guides with sheaves for cables to raise and lower the crucible furnace by a rack and pinion.

The air passes from blower to burner through a conduit in the lining, and is raised to a temperature of 450° to 550° F. The flame enters the combustion chamber tangentially, swirls about the stool and crucible and completely fills the space. With an air temperature between 450° and 550° F., a brass melting temperature of 2,100° is easily maintained, and temperatures sufficient to melt mild steel have been reached.

The increase in efficiency due to the pre-heating of the air has been shown to be 19.71% with natural gas.

Furnace Opened.

The furnace shown is designed for a No. 60 crucible, is 34 inches high and occupies a floor space of 2 by 4 feet. A swinging cover is provided on top of the furnace, permitting convenient access to the crucible for stirring and for additions to the charge. The crucible is withdrawn by an open side shank. This No. 60 furnace weighs about 1,600 pounds. For very small charges a tilting design is made embodying all the features of the furnace illustrated.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE city of New Britain, Conn., is being sued for damage to a building by a bursting water main, and attributes the failure of the main to electrolysis; and the local gas company also complains of considerable trouble from stray electric currents. Because of this the Corporation Counsel has prepared for presentation to the Legislature a bill which proposes to make electric railway companies liable for all electrolytic damage to underground structures, including gas and water pipes.

ACCORDING to the statistics for the year 1913, the annual gas consumption in Japan exceeds 5,000,000,000 cubic feet with a value of 9,000,000 *yen*. The number of meters in service is nearly 600,000. Of the above figures Tokio alone has a consumption of over 3,000,000,000 cubic feet, and its meters are over the half of the total number.

T. T. KENNEDY has secured a franchise to build a gas works in West Palm Beach, Fla., and has appointed A. J. McArthur, of the Dixie Engineering Company, of Atlanta, Ga., as Engineer. He will most likely install a modern water gas plant, with complete system of mains, etc., and will start work within the next 60 days.

THE Safety First Committee of the Louisville (Ky.) Gas and Electric Company's Employees Club made its first award of prizes for the best suggestions at the last meeting of the club. R. H. Moore, a switchboard operator received the first prize of $5; Frank Pfeiffer, paymaster, second prize, $3; Thomas A. Clare, assistant operating engineer, third prize, $2. Arrangements have been made to put into effect a large number of the suggestions received. One of the slogans adopted was, "Report a defect and you will not have to report an accident."

MR. ADOLPH F. WEHNER, Secretary of the Isbell-Porter Company, died last week at his late residence in Newark, N. J., after a long and severe illness, in his 56th year. Mr. Wehner was a graduate of Yale-Sheffield, Class of 1880, and was employed in 1882 by the old Smith & Sayre Manufacturing Company, which was succeeded by the Isbell-Porter Company in 1890. On the organization of the Isbell-Porter Company, Mr. Wehner was elected a Director, becoming the secretary in 1894, upon the death of Mr. George G. Porter. He was a Director and Secretary of the company continuously thereafter until his death.

A LOCAL paper says that on Monday, Jan. 18, the Hamburg (Pa.) Gas and Electric Company turned off the gas supply to make repairs to the gas generator and add new features, and the supply will not be renewed perhaps for a week. This is the first time since the erection of the plant, about 10 years ago, that there will have been an interruption of service.

ANOTHER frost report. The employees of the Newburyport (Mass.) Gas and Electric Company, who have been setting new poles at the north end state that they have encountered about two feet of frost in the ground as they have excavated holes. This is a much less amount than ordinarily found at this time of the year.

THE gas rate of the West Side Gas Company for natural gas in the city of Maricopa, Cal., has been fixed at a flat rate of 80c. per 1000 cubic feet. The former rate charged since the cut made voluntary by the company, was 90c. per 1000 cubic feet with a 10% discount if the bills were paid before the 10th of each month. The new rate is 1 cent lower than that made by the company, and was made to apply on all December gas bills.

ALL directors of the Omaha (Neb.) Gas Company were re-elected at the annual meeting of stockholders. The directors then met and re-elected their officers. Directors are Frank T. Hamilton, George E, Baker, G. W. Clabaugh, W. F. Douthirt and Fred P. Hamilton. Officers are Frank T. Hamilton, president; G. W. Clabaugh, vice-president and secretary; Lewis Lillie, treasurer; L. W. Weymuller, assistant treasurer; James Ball, assistant secretary.

THE New York Consolidated Gas Company gave a bonus of $10 to each of the 7 men of the emergency squad whose efficient work helped revive the victims of the subway accident a few weeks ago. With the gift was a short note of appreciation from President Cortelyou.

THIRTY committee members of the Southwestern Electrical and Gas Association met last month in Fort Worth, Tex., to discuss the program for the next annual convention at Galveston, May 19, 20, 21 and 22. The attendance included engineers of electrical plants, artificial and natural gas companies, water and ice plants and street and interurban railways. George H. Clifford, Manager of the Northern Texas Traction Company, headed the meeting. The question of standardization of equipment and of accounting systems of the companies represented came up for discussion, and the proposition of revising the constitution of the organization.

AFTER 74 actual trial days, the taking of evidence in the case against the Utah Gas and Coke Company for an injunction abating the operation of the Company's gas plant in Salt Lake City, has been concluded, and the attorneys are prepared for arguments. Each side will have two days in which to make the closing arguments. The plaintiffs aver that the gases, odors and noises eminating from the plant are injurous to health and property.

THE Gas Workers Association of Lowell, Mass., made its initial dancing bow to the public last week, when members and friends gathered in A. O. H. Hall for the annual social and hop. It is no exageration to say that one of the largest crowds of the season was in attendance and the evening passed quickly and pleasantly. A feature of the program was an exhibition dance by Mr. and Mrs. Dominick Monahan. The officers in charge were as follows: General manager, James McCarthy; assistant general manager, William Peters; floor director, Thos. Neylan; assistant floor director, Edward Connors; chief aids, John McCafferty, John Flynn; aids, J. Howe, M. Reagan, J. Vaughan, D. Daly, M. Molloy, P. Tarpey, R. O'Connor, P. Cullen, T. Quirk, C. Donohue, J. Tully, T. Connors, W. Burtt, T. Dwyer; D. Monahan, treasurer.

THE terms upon which the Grand Rapids (Mich.) Gas Company will accord a reduction of rates are specified in a letter from Mr. Emerson McMillan, president of the American Light and Traction Company. The rate named in view of a renewal of the franchise is 75 cents per 1,000 cubic feet for five years, or until the expiration of the present franchise; the 75 cent rate to prevail for the first five years of a new franchise, the rate thereafter to be determined by the State Board of Arbitration if such a board exists, or by a local board of arbitration at five year periods. The city is also given the privilege of purchasing the franchise at the termination of the new franchise, at the end of 20 years, or during the five-year periods, providing the company is given two years advance notice of such determination to purchase. Mayor Ellis says that the people of the city are kindly disposed toward the gas company, but desire a larger share in the benefits arising from the growth of the city, and will probably insist on a 70 cent rate. The other provisions of the proposition seem to meet his views.

"T. G. C." WRITING from Amarillo, Tex., says the Amarillo Gas Company is getting busy and is taking an active part in Amarillo's "white way." This week they have moved their offices from Taylor street to the Powell building on Polk street, and in front of their offices have erected three high power gas lamps, which add materially to the attractiveness and brilliancy of that portion of the city.

THE Galesburg (Ills.) Railway, Light and Power Company has named L. E. Fisher of St. Louis, as its arbitrator in the gas rate controversy between the city and the company, said to be a gas expert. The city council recently named D. L. Peterson as its arbitrator, but Mr. Peterson declined to serve, and at the last council meeting the matter was referred to the circuit judge for the appointment of an arbitrator.

IT is reported from New Orleans, La., that further shifts among the operating heads of the United Gas and Electric Corporation and subsidiary companies are in prospect. It is said that Mr. George Bullock will retire as president of the United Company, his place to be taken by James S. Pevear, who was succeeded as president and general manager of the New Orleans Railway and Light Company by D. D. Curran, some weeks ago. Mr. Bullock will become chairman of the board and head of the finance department of the united concern. Mr. S. G. Dill, of New York, will go to New Orleans as the operating head of all the southern properties of the United Gas and Electric corporation, including the plants in New Orleans, Houston, Birmingham and Little Rock.

ANNOUNCEMENT is made by the Fitchburg (Mass.) Gas and Electric Light Company that the price of gas and electricity will be reduced as a result of the conferences between the officials of the company, officials of the Board of Trade and Merchants Association, Judge Thomas F. Gallagher and others. On and after July 1, the price of gas will be $1 per 1,000, and the officials agree to recommend to the directors of the company a reduction in the price of electricity from 12 cents per kw.-hour net to 11 cents net on Jan. 1, 1816, providing at that time the company's earnings and prospects for earnings justify such a reduction.

A BILL has been prepared for presentation to the Massachusetts Legislature providing for the yearly inspection of all gas meters in the State by the Commissioner of Weights and Measures

THE Detroit City Gas Company has paid to the city of Detroit, Mich., $1,093.86 as its percentage on the company's sales during 1914.

AT the annual meeting of the Grand Island (Neb.) Gas Company control of the company passed to local stockholders, together with W. H. Ferguson, of Lincoln, and C. J. Miles, of Hastings. Extensive improvements and betterment of the works are contemplated, and the company has secured A. W. Borden, of Hastings, to superintend the improvements. The purpose of the company is to make the plant up-to-date in every respect and furnish the best possible service to the public. The company organized with the election of C. J. Miles, president; C. G. Ryan, vice-president; C. R. Heusinger, secretary and superintendent; C. C. Hansen, treasurer.

MR. JAMES MITCHELL, of the Alabama Traction Light and Power Company, is quoted as saying that the company will spend $100,000 in the erection of a new gas plant in Anniston. Work on the improvements is already under way.

THE Connersville (Ind.) Peoples Service Company, formerly supplying natural gas and later mixed natural and artificial gas, will now supply the made variety at $1 per 1,000 cubic feet. Beginning January 1st, it will also pay 5% interest on meter deposits.

THE Commissioners' Court of Neuces County, Tex., has granted to the Corpus Christi Gas Company a franchise to extend its gas mains from Corpus Christi, along the highways, roads, streets and other public places of Nueces County. The gas, either natural or artificial, is to be sold at the same price that the company sells to patrons within the city, and in practically all things the franchise is a duplicate of the one given the company several years ago by the city council and under which it now operates.

AT the annual meeting of the People's Gas Light Company, Manchester, N. H., the following officers were elected: President, Arthur M. Heard; vice-president, Thomas Rice Varick; treasurer and clerk, Walter G. Africa; directors, Arthur M. Heard, Walter G. Africa, George W. Curran, Charles C. Hayes, Walter M. Parker, W. B. Stearns and Thomas R. Varick.

BEGINNING with the first of the year the Lansing (Mich,) Fuel and Gas Company inaugurated a department covering free maintenance of all appliances, sending out experienced men to go from house to house and properly regulate lights and other fixtures. The men carry mantles, glassware and similar accessories for sale, and, in addition, will adjust all gas ranges, water heaters and gas irons without charge except for material. Similar service has always been granted by the company upon request of patrons, but the management decided to extend the service department to those not acquainted with it, and to those who might think their fixtures are properly regulated when actually they may be wasteful of the fuel or giving unsatisfactory service.

ALL the directors and officers of the Hartford (Conn.) City Gas Light Company were re-elected at the annual meeting as follows: President, E. B. Bennett; vice-president, George Bullock; secretary-and treasurer, John A. McArthur; assistant secretary, John T. Robinson; assistant treasurer, W. A. Kneeland; general manager, Benjamin W. Perkins: directors, Edward B. Bennett, Francis R. Cooley, John T. Robinson, George Roberts, John R. Hills, Samuel G. Dunham, S. R. Bertron, George Bullock, James H. Knight.

UTILITIES COMMISSION NEWS.

TO LIMIT VALUE OF FRANCHISES.—To offset the recent decision of the New Jersey Court of Errors and Appeals, setting aside its 90-cent gas order, the Board of Commissioners has recommended to the Legislature the passage of a law which would prohibit the franchises of public utilities having in the fixing of rates a valuation in excess of the legitimate cost of obtaining them.

NEW MEMBER OF CALIFORNIA COMMISSION.—The personnel of the new Railroad Commission of California, which took office on Jan. 4, under appointments from Governor Johnson, is the same as heretofore with the exception of Mr. Frank R. Devlin, named to fill the vacancy caused by the election of Mr. John M. Eshleman, former President of the Commission, as Lieutenant-Governor. As now organized the members and their terms of office are as follows: Mr. Max Thelen, president, 6 years; Edwin O. Edgerton, 6 years; H. A. Loveland, 4 years; Frank R. Devlin, 4 years, and Alex. Gordon, 2 years. Mr. Douglas Brookman has been named as attorney for the new commission, which announces that all present employees will be retained.

TO KEEP OUT COMPETITOR.—Application has been made to the California Commission, by the Midland Counties Public Service Corporation for an order restraining the Santa Maria Gas and Power Company from distributing natural gas in the City of San Luis Obispo. The Midland Company asks that the Santa Maria company be required to wholesale to them natural gas for distribution within the city, insomuch that it already has a plant installed.

MAINE PUBLIC UTILITIES ACT.—At the recent general election in Maine the Public Utilities Act, passed by the 1913 Legislature, was accepted by a referendum vote. The statute provides for the appointment by the Governor of a board of 3 members to be designated the Public Utilities Commission, the chairman having a salary of $5,000 per year, and the other two commissioners $4,500 each. The chairman first appointed is to have a term of 7 years, and the other members 5 and 3 years respectively, subsequent appointments being for 7 years. The clerk is to receive $2,500. The office is to be at the Capitol in Augusta. The right to employ expert assistance is accorded.

Power is given to the commission to inquire into the management of all public utilities, including common carriers, gas, electric, telephone, telegraph and water companies, wharfingers and warehousemen. The board or its representatives receive power to inspect books, papers, etc., to require the production of these, to investigate any neglect or violations of law by public utilities or their employees and agents, reporting all violations to the Attorney General, who, with county attorneys, is required to help the commission.

All rates are to be reasonable and just, taking into account the value of the property with a fair return thereon, its rights and plant as a going concern, business risk and depreciation. Accounts are to be kept in the manner and form prescribed by the board, consideration being given by the latter to systems established by Federal law and other commissions.

NEW YORK COMMISSIONS.—Governor Whitman, of New York, previous to his election, declared his intention to investigate the two State Utility Commissions, and bills carrying out his wishes have been introduced in the Legislature. It seems likely that eventually a single Commission will cover the whole State instead of the division between New York City and outside the city as at present.

IMPOSSIBLE TO SELL NOTES.—The Southern Counties Gas Company of California has filed an application with the commission requesting authority to issue $54,869.64 of promissory notes to be secured by the pledge of its 3 year gold notes. The company states that owing to financial conditions, it finds it impossible to sell any of its gold notes at the present time. The company has also filed an application requesting authority to renew promissory notes now outstanding in the sum of $66,007.89.

The commission has rendered a decision authorizing the San Joaquin Light and Power Corporation to renew certain promissory notes aggregating $92,500.

The commission has rendered a decision authorizing the Midland Counties Public Service Corporation to renew promissory notes aggregating $24,795.67.

Financial Notes.

THE bond department of H. M. BYLLESBY & COMPANY, Chicago and New York, has issued an attractive booklet, describing the various bond and note investments which it is offering to the public. All of the securities described has been issued by utility companies under the engineering and commercial management of H. M. Byllesby & Company, and include the following: Consumers Power Company of Minnesota; Mobile Electric Company, Muskogee Gas and Electric Company, Oklahoma Gas and Electric Company, Northern Mississippi River Power Company, Western States Gas and Electric Company, Louisville Gas and Electric Company and Standard Gas and Electric Company.

THE CONSOLIDATED GAS COMPANY, New York, reports for the year ended December 31, 1914, a surplus of $1,130,691 after paying dividends, as compared with $1,246,959 in the preceding year. The total net income from the sale of gas and electric current, including the revenue of the Astoria Light, Heat and Power Company, was $2,137,922. Income from investments and other sources amounted to $5,808,716, making an aggregate of $7,046,-638, against $8,123,805 in 1913. Of this, $5,988.000 in dividends and $826,956 in interest was paid out. The output of gas in the night period in the Boroughs of Manhattan and the Bronx and in Long Island City, was about 700,000,000 cubic feet less than in 1912, and was the same as in 1909. On the other hand, the amount distributed in the day period showed an increase of 1,000,000,000 cubic feet over 1912, and 3,200,000,000 cubic feet over 1909. The amount of subscriptions received to the offering to stockholders of $25,000,000 6% convertible bonds, was approximately $24,200,000, leaving a balance of abont $800,000 not taken. The first payment of 30% of the entire amount is due on February 1st. Those not desiring to pay for their bonds in full on the date, however, may pay 30%, then 30% on May 1 and the balance on July 31.

THE last sale of WESTERN STATES GAS AND ELECTRIC preferred was 60, and it is now quoted at 60 bid. As its selling price indicates, the issue is hardly classed as an investment of very high grade, but it pays dividends at the rate of 7%, and those who are in touch with the company's affairs think the chances favor the continuation of this rate of disbursement. If earnings expand suffiiciently the stock will sell considerably higher.

PRESIDENT STROUD of AMERICAN GAS COMPANY says: "To pay for improvements and extensions directors have resolved to offer stockholders of record Jan. 25 the right to subscribe to new stock at par to the extent of 20% of their holdings. Stockholders may pay 50% on February 17 and 50% on or before June 1, or in full February 17."

A DIRECTOR of THE BROOKLYN UNION GAS COMPANY says: "Output of Brooklyn Union Gas in calendar year 1914 increased 5%. There was no change in rate charged for gas, so that gross earnings show likewise a 5% increase. Gross earnings in 1914 approximated $10,700,000 against $10,218,514 in 1913."

THE PACIFIC GAS AND ELECTRIC COMPANY will not oppose the collection of four $2,500 bonds held by the city of Sacramento on franchises granted in October, 1911, which were abandoned by the company some time ago. As a result of this move, the city treasury will be enriched by $10,000.

A PORTLAND (Ore.) GAS AND COKE COMPANY 7% preferred dividend of 1¾%, payable February 1 to stockholders of record January 23, has been declared.

JUDGE HAND, in the U. S. District Court for the Southern District of New York, has issued an order to show cause, in the petition for intervention made by Madeline I. Dinsmore in the case of the American Trust Company against the ATLANTIC GAS & ELECTRIC COMPANY, Calvert Brewer, trustee of American Gas & Electric Company, in bankruptcy, and Pennsylvania Utilities Company. The petition asks for an order permitting the petitioner to intervene on behalf of herself and other Series "A" bondholders similarly situated, and to be made a party defendant of the action, so that she may have the right to be heard and to review any order or decree that may be made. The American Trust Company is the trustee for the Series A and B bonds of the Atlantic Gas & Electric Company, and brought action against the company last winter. The petitioner, Miss Dinsmore, is the owner and holder of $255,000 par value of the first lien, sinking fund Series A bonds of the defunct company. Recently a plan of reorganization was announced by the stockholders' committee which gave the stockholders until January 31 to signify their intention of participating in the plan and paying the first instalment of the assessment provided for by the plan.

THE MADISON (WIS.) GAS & ELECTRIC COMPANY has been granted permission by the state railroad commission to increase its capital stock by $650,000.

THE WISCONSIN RAILWAY, LIGHT AND POWER COMPANY has elected the following officers: President, Clement C. Smith; Vice-Presidents, Ludington Patton and Henry L. Rice; Secretary-Treasurer, Howard Greene; Assistant Secretary-Treasurer, George Allison. Directors, Frank O. Wetmore, Frank P. Hixon, H. L. Stewart, Olliver C. Fuller, John I. Beggs, Fred Vogel, Jr., J. W. P. Lombard and William Bigelow.

THE OHIO CITIES GAS COMPANY has declared the regular quarterly dividend of 1¼% on its common stock, payable March 1.

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